FINAL REPORT

SR 87/SR 260/ SR 377 Corridor Profile Study

Junction 202L to Junction I-40

PREPARED FOR ADOT MARCH 2017

ADOT WORK TASK NO.
MPD 028-16

ADOT CONTRACT NO.
11-013152

Prepared by

Kimley»Horn

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ARIZONA DEPARTMENT OF TRANSPORTATION

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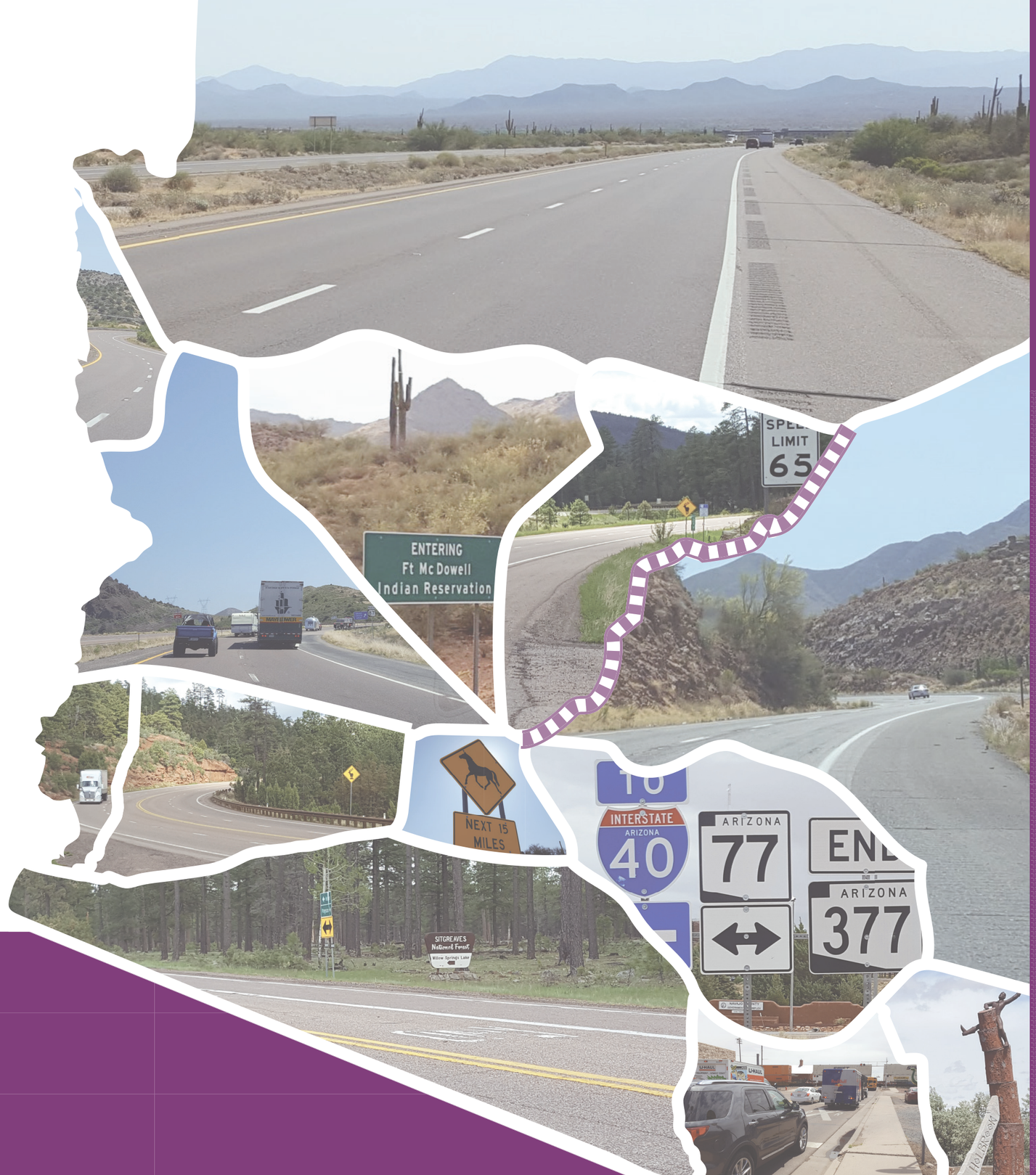
ACRONYMS & ABBREVIATIONS

AADT	Average Annual Daily Traffic
ABISS	Arizona Bridge Information and Storage System
ADOT	Arizona Department of Transportation
AGFD	Arizona Game and Fish Department
ASLD	Arizona State Land Department
AZTDM	Arizona Statewide Travel Demand Model
BLM	Bureau of Land Management
BQAZ	Building a Quality Arizona
CAG	Central Arizona Governments
CCTV	Closed Circuit Television
CR	Cracking Rating
DCR	Design Concept Report
DMS	Dynamic Message Sign
EB	Eastbound
FHWA	Federal Highway Administration
FY	Fiscal Year
HCRS	Highway Condition Reporting System
HERE	Real time traffic conditions database produced by American Digital Cartography Inc.
HPMS	Highway Performance Monitoring System
I	Interstate
IRI	International Roughness Index
ITS	Intelligent Transportation System
LCCA	Life-Cycle Cost Analysis
LOS	Level of Service
LRTP	Long-Range Transportation Plan
MAG	Maricopa Association of Governments
MAP-21	Moving Ahead for Progress in the 21st Century
MP	Milepost
MPD	Multimodal Planning Division
NACOG	Northern Arizona Council of Governments
NB	Northbound
NPV	Net Present Value
OP	Overpass
P2P	Planning-to-Programming
PA	Project Assessment
PARA	Planning Assistance for Rural Areas
PDI	Pavement Distress Index
PES	Performance Effectiveness Score
PSR	Pavement Serviceability Rating
PTI	Planning Time Index
RWIS	Road Weather Information System
SATS	Small Area Transportation Study
SB	Southbound
SHSP	Strategic Highway Safety Plan
SOV	Single Occupancy Vehicle
SR	State Route
TAC	Technical Advisory Committee
TI	Traffic Interchange
TOAS	Traffic Operational Analysis Study
TPTI	Truck Planning Time Index
TTI	Travel Time Index
TTTI	Truck Travel Time Index
UP	Underpass
V/C	Volume-to-Capacity Ratio
VMT	Vehicle-Miles Travelled
WB	Westbound
WIM	Weigh-in-Motion



Executive Summary

EXECUTIVE SUMMARY

INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of State Route 87 (SR 87)/State Route 260 (SR 260)/State Route 377 (SR 377) between State Route 202L (Loop 202) and Interstate 40 (I-40). This study examines key performance measures relative to the SR 87/SR 260/SR 377 corridor, and the results of this performance evaluation are used to identify potential strategic improvements. The intent of the corridor profile program, and of ADOT's Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT is conducting eleven CPS within three separate groupings. The SR 87/SR 260/SR 377 corridor, depicted in **Figure ES-1**, is one of the strategic statewide corridors identified and the subject of this CPS.

Corridor Study Purpose, Goals and Objectives

The purpose of the CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

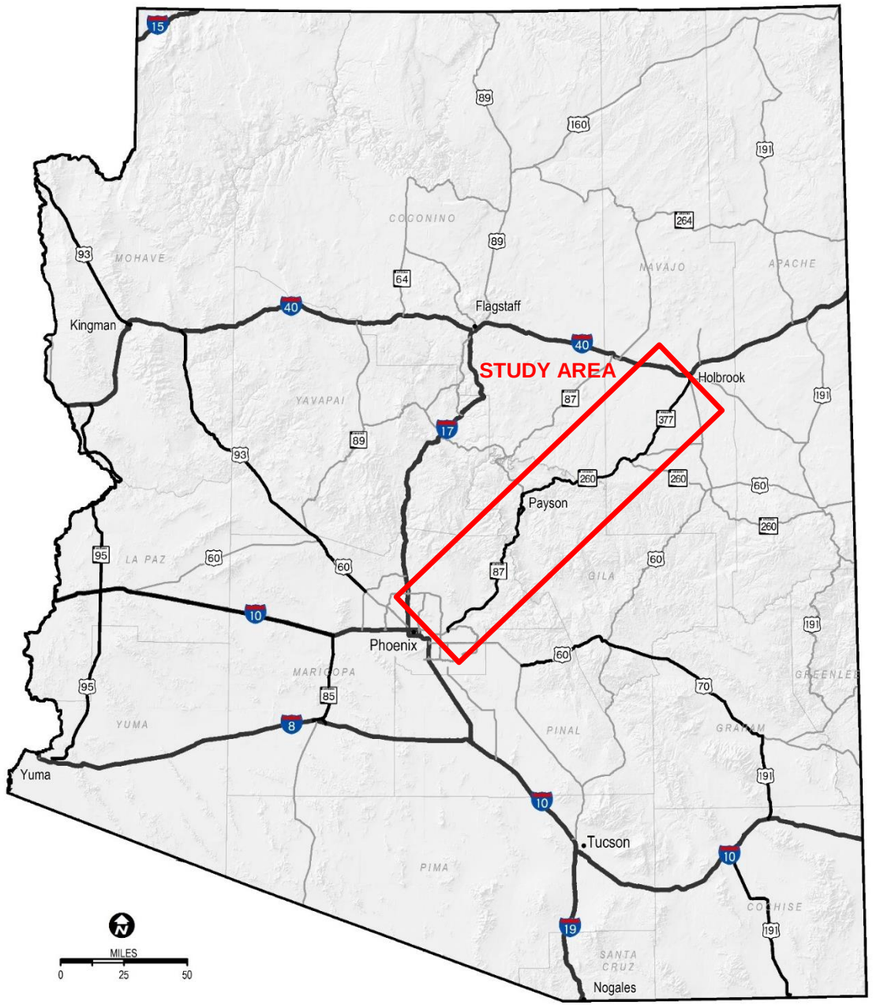
- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation, accounting for performance effectiveness and risk analysis findings

The objective of this study is to identify a recommended set of prioritized potential solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The SR 87/SR 260/SR 377 CPS defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance.

The following goals are identified as the outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

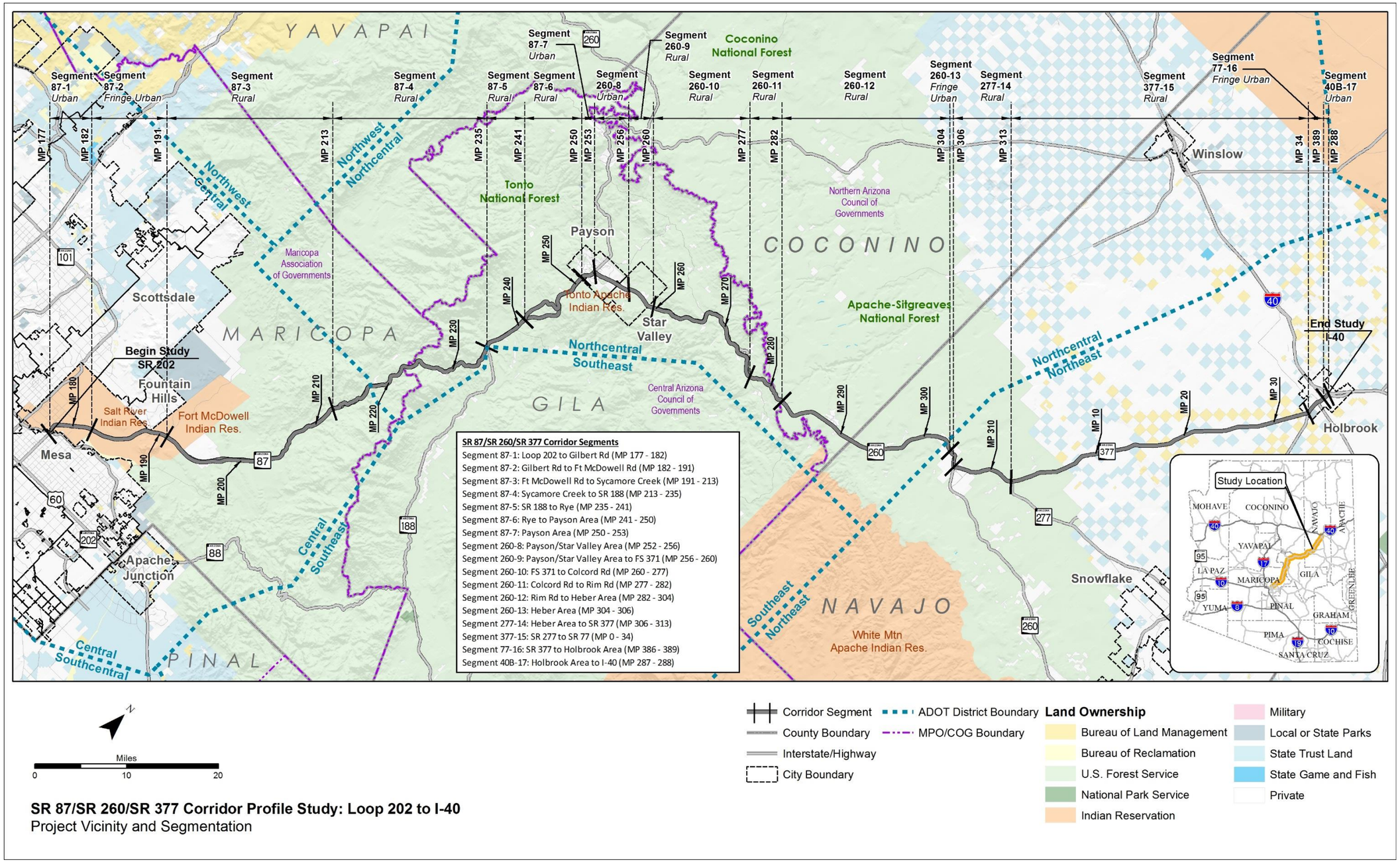
Figure ES-1: Corridor Study Area



Study Location and Corridor Segments

The SR 87/SR 260/SR 377 corridor is divided into 17 planning segments for analysis and evaluation. The corridor is segmented at logical breaks where the context changes due to differences in characteristics such as terrain, daily traffic volumes, or roadway typical sections. Corridor segments are shown in **Figure ES-2**.

Figure ES-2: Corridor Location and Segments



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Project Vicinity and Segmentation

CORRIDOR PERFORMANCE

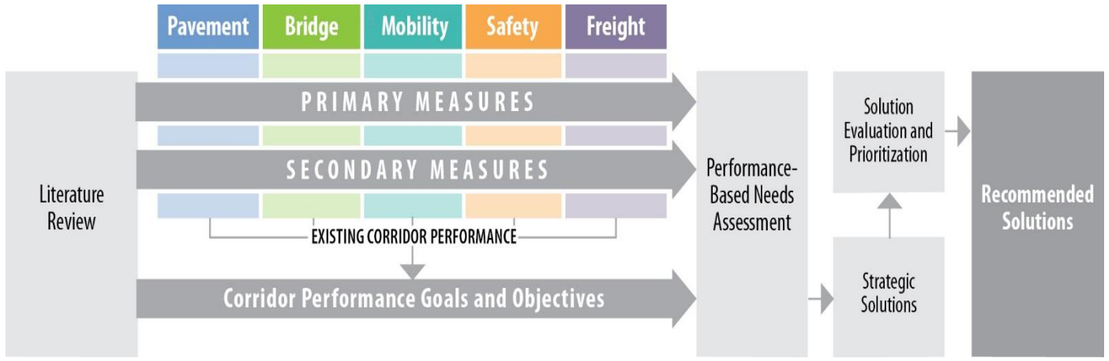
A series of performance measures is used to assess the SR 87/SR 260/SR 377 corridor. The results of the performance evaluation are used to define corridor needs relative to the long-term goals and objectives for the corridor.

Corridor Performance Framework

This study uses a performance-based process to define baseline corridor performance, diagnose corridor needs, develop corridor solutions, and prioritize strategic corridor investments. In support of this objective, a framework for the performance-based process was developed through a collaborative process involving ADOT and the CPS consultant teams.

Figure ES-3 illustrates the performance framework, which includes a two-tiered system of performance measures (primary and secondary) to evaluate baseline performance.

Figure ES-3: Corridor Profile Performance Framework



The following five performance areas guide the performance-based corridor analyses:

- Pavement
- Bridge
- Mobility
- Safety
- Freight

The performance measures include five primary measures: Pavement Index, Bridge Index, Mobility Index, Safety Index, and Freight Index. Additionally, a set of secondary performance measures provides for a more detailed analysis of corridor performance. **Table ES-1** provides the complete list of primary and secondary performance measures for each of the five performance areas.

Table ES-1: Corridor Performance Measures

Performance Area	Primary Measure	Secondary Measures
Pavement	**Pavement Index** Based on a combination of International Roughness Index and cracking	• Directional Pavement Serviceability • Pavement Failure • Pavement Hot Spots
Bridge	**Bridge Index** Based on lowest of deck, substructure, superstructure and structural evaluation rating	• Bridge Sufficiency • Functionally Obsolete Bridges • Bridge Rating • Bridge Hot Spots
Mobility	**Mobility Index** Based on combination of existing and future daily volume-to-capacity ratios	• Future Congestion • Peak Congestion • Travel Time Reliability • Multimodal Opportunities
Safety	**Safety Index** Based on frequency of fatal and incapacitating injury crashes	• Directional Safety Index • Strategic Highway Safety Plan Emphasis Areas • Crash Unit Types • Safety Hot Spots
Freight	**Freight Index** Based on bi-directional truck planning time index	• Recurring Delay • Non-Recurring Delay • Closure Duration • Bridge Vertical Clearance • Bridge Vertical Clearance Hot Spots

Each of the primary and secondary performance measures identified in the table above is comprised of one or more quantifiable indicators. A three-level scale was developed to standardize the performance scale across the five performance areas, with numerical thresholds specific to each performance measure:

Good/Above Average Performance – Rating is above the identified desirable/average range

Fair/Average Performance – Rating is within the identified desirable/average range

Poor/Below Average Performance – Rating is below the identified desirable/average range

The terms “good”, “fair”, and “poor” apply to the Pavement, Bridge, Mobility, and Freight performance measures, which have defined thresholds. The terms “above average”, “average”, and “below average” apply to the Safety performance measures, which have thresholds referenced to statewide averages.

Corridor Performance Summary

Table ES-2 shows a summary of corridor performance for all primary measures and secondary measure indicators for the SR 87/SR 260/SR 377 corridor. A weighted corridor average rating (based on the length of the segment) was calculated for each primary and secondary measure as shown in **Table ES-2**. The following general observations were made related to the performance of the SR 87/SR 260/SR 377 corridor:

- Overall Performance: The Pavement, Bridge, and Mobility performance areas show generally "good" or "fair" performance; Safety and Freight performance areas show generally "poor/below average" or "fair/average" performance
- Pavement Performance: The weighted average of the Pavement Index shows "good" overall performance; exceptions include Segments 260-13, 277-14, and 77-16, which show either "poor" or "fair" performance for the Pavement Index, Directional Pavement Serviceability Rating (PSR), and % Area Failure measures; no data was available for Segment 40B-17
- Bridge Performance: The weighted average of the Bridge Index shows "good" overall performance; all segments that include bridges have "good" or "fair" performance for Bridge Index, Sufficiency Rating, and Lowest Bridge Rating measures; Segment 77-16 shows "poor" performance for the % of Deck Area on Functionally Obsolete Bridges; Segments 87-6, 87-7, 260-8, 260-9, 277-14, 377-15, and 40B-17 contain no bridges
- Mobility Performance: The weighted average of the Mobility Index shows "good" overall performance; Closure Extent, Directional Planning Time Index (PTI), % Bicycle Accommodation, and % Non-Single Occupancy Vehicle (SOV) Trips show "poor" or "fair" performance for the corridor; Segments 87-2, 87-7, 260-9, and 77-16 show either "poor" or "fair" performance in the Mobility Index and Future Daily V/C measures
- Safety Performance: The weighted average of the Safety Index and Directional Safety Index show "below average" overall performance; in the 2010-2014 analysis period, there were 48 fatal crashes and 81 incapacitating crashes on the corridor; Segments 87-7, 260-9, 260-13, 277-14, 77-16, and 40B-17 have "insufficient data", meaning that there was not enough data available to generate reliable performance ratings so no values were calculated
- Freight Performance: The weighted average of the Freight Index shows "poor" performance; Closure Duration, Directional Truck Travel Time Index (TTTI), and Directional Truck PTI show "poor" or "fair" performance for the corridor; no TTTI or TPTI data was available for Segments 277-14 and 377-15; no Closure Duration data was available for Segment 40B-17
- Lowest Performing Segments: Segments 87-3, 87-4, 260-9, and 77-16 show "poor/below average" performance for many performance measures
- Highest Performing Segments: Segments 87-2 and 87-7 show "good/above average" performance for many performance measures

Table ES-2: Corridor Performance Summary by Segment and Performance Measure

Segment #	Segment Length (miles)	Pavement Performance Area				Bridge Performance Area				Mobility Performance Area											
		Pavement Index	Directional PSR		% Area Failure	Bridge Index	Sufficiency Rating	% of Deck Area on Functionally Obsolete Bridges	Lowest Bridge Rating	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/ milepost/year/mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips
			NB/EB	SB/WB								NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB		
87-1[1*a]	5	4.19	4.03	4.11	10.0%	7.00	85.00	0.0%	7	0.65	0.86	0.34	0.34	0.37	0.32	1.22	1.06	4.01	3.03	45%	13.6%
87-2[1* a]	9	4.25	4.01	4.14	0.0%	7.00	96.50	0.0%	7	0.73	1.01	0.45	0.45	0.46	0.04	1.15	1.23	2.36	3.86	93%	14.4%
87-3[2^ a]	22	3.80	3.80	3.88	11.4%	6.95	96.20	0.0%	6	0.21	0.29	0.14	0.13	0.87	0.11	1.05	1.04	1.54	1.48	99%	16.7%
87-4[2^ a]	22	4.05	3.84	3.93	0.0%	6.31	89.18	0.0%	6	0.23	0.27	0.20	0.21	1.47	0.15	1.17	1.05	2.05	1.47	86%	5.2%
87-5[2^ a]	5	4.55	4.35	4.36	0.0%	6.31	99.60	0.0%	6	0.15	0.14	0.15	0.15	0.23	0.07	1.01	1.08	1.42	1.51	92%	12.9%
87-6[2^ a]	10	4.15	4.10	3.96	0.0%	No Bridges				0.21	0.21	0.19	0.19	0.18	0.27	1.31	1.15	2.38	1.94	79%	12.4%
87-7[1* b]	2	3.54	3.36	3.48	0.0%	No Bridges				0.75	0.94	0.57	0.50	0.07	0.20	1.18	1.86	4.43	6.48	56%	18.4%
260-8[1* b]	4	4.31	4.24		0.0%	No Bridges				0.54	0.68	0.47	0.51	0.05	0.00	1.46	1.10	7.15	4.97	16%	18.5%
260-9[2^ c]	3	4.27	4.12		0.0%	No Bridges				0.94	1.15	1.29	1.33	0.30	0.55	1.12	1.00	1.61	1.16	2%	15.1%
260-10[2^ a]	17	4.03	3.79	3.81	0.0%	6.81	99.52	0.0%	6	0.08	0.08	0.13	0.11	0.49	0.48	1.13	1.06	1.64	1.40	93%	16.2%
260-11[2^ c]	5	4.13	3.98		0.0%	6.73	79.13	0.0%	6	0.12	0.14	0.14	0.13	0.40	0.88	1.23	1.00	2.16	1.14	49%	12.5%
260-12[2^ c]	22	3.78	3.52		4.5%	7.00	98.40	0.0%	7	0.36	0.39	0.34	0.34	0.43	0.85	1.00	1.05	1.18	1.36	2%	10.8%
260-13[1^ b]	2	3.11	2.87		50.0%	6.00	93.70	0.0%	6	0.14	0.15	0.14	0.14	0.00	0.40	1.02	1.21	1.63	2.98	15%	6.7%
277-14[2^ c]	7	2.05	3.03		71.4%	No Bridges				0.09	0.10	0.07	0.06	0.11	0.00	No Data				0%	17.5%
377-15[2^ c]	34	4.12	4.03		0.0%	No Bridges				0.09	0.10	0.13	0.13	0.04	0.05	No Data				0%	18.2%
77-16[1* c]	2	3.25	3.10		40.0%	6.00	59.00	100.0%	6	0.85	1.09	0.60	0.65	0.00	0.00	1.08	1.49	3.84	6.79	1%	18.7%
40B-17[1* b]	1	No Data				No Bridges				0.45	0.57	0.32	0.32	No Data		1.80	1.31	12.93	10.56	27%	20.7%
Weighted Corridor Average		3.94	3.83	3.86	6.4%	6.70	95.46	1.6	6.06	0.26	0.32	0.24	0.23	0.49	0.27	1.13	1.09	2.15	2.03	49%	14.0%

SCALES

Performance Level	Non-Interstate		All				Urban and Fringe Urban	All	Uninterrupted		All	
Good/Above Average	> 3.50	< 5%	> 6.5	> 80	< 12%	> 6	< 0.71	< 0.22	< 1.15	< 1.3	> 90%	> 17%
Fair/Average	2.90 - 3.50	5% - 20%	5.0 - 6.5	50 - 80	12% - 40%	5 - 6	0.71 - 0.89	0.22 - 0.62	1.15 - 1.33	1.3 - 1.5	60% - 90%	11% - 17%
Poor/Below Average	< 2.90	> 20%	< 5.0	< 50	> 40%	< 5	> 0.89	> .62	> 1.33	> 1.5	< 60%	< 11%

Performance Level	Rural	Interrupted	
Good/Above Average	< 0.56	< 1.3	< 3.0
Fair/Average	0.56 - 0.76	1.3 – 2.0	3.0 – 6.0
Poor/Below Average	> 0.76	> 2.0	> 6.0

^Uninterrupted Flow Facility
*Interrupted Flow Facility
[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway
[1]Urban Operating Environment
[2]Rural Operating Environment

Table ES-2: Corridor Performance Summary by Segment and Performance Measure (continued)

Segment #	Segment Length (miles)	Safety Performance Area							Freight Performance Area							
		Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	% of Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers	Freight Index	Directional TTTI		Directional TPTI		Closure Duration (minutes/milepost/year/mile)		Bridge Vertical Clearance (feet)
			NB/EB	SB/WB						NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	
87-1[1]*	5	3.01	4.05	1.98	29%	Insufficient Data	Insufficient Data	Insufficient Data	0.28	1.29	1.10	3.88	3.38	129.19	61.92	No UP
87-2[1]*	9	0.62	1.21	0.04	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.29	1.19	1.32	2.72	4.06	119.84	147.44	No UP
87-3[2]^	22	1.19	0.48	1.90	44%	Insufficient Data	39%	Insufficient Data	0.53	1.11	1.23	1.38	2.38	2674.13	59.23	16.97
87-4[2]^	22	1.62	1.48	1.76	30%	Insufficient Data	50%	Insufficient Data	0.51	1.37	1.14	2.38	1.56	4359.89	34.01	18.75
87-5[2]^	5	1.22	0.08	2.36	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.56	1.12	1.21	1.45	2.13	49.20	21.67	No UP
87-6[2]^	10	2.11	0.09	4.13	71%	Insufficient Data	14%	Insufficient Data	0.44	1.55	1.22	2.52	2.01	37.16	287.98	No UP
87-7[1]*	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.28	1.20	1.91	3.29	3.88	21.33	693.60	No UP
260-8[1]*	4	0.28	0.56	0.00	43%	Insufficient Data	Insufficient Data	Insufficient Data	0.15	1.66	1.17	9.64	4.11	11.45	0.00	No UP
260-9[2]^	3	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.47	1.20	1.00	3.09	1.21	71.85	726.90	No UP
260-10[2]^	17	0.93	0.62	1.24	50%	Insufficient Data	13%	Insufficient Data	0.58	1.23	1.12	1.82	1.61	157.49	797.71	No UP
260-11[2]^	5	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.54	1.45	1.00	2.53	1.18	144.40	922.04	No UP
260-12[2]^	22	1.43	2.25	0.62	46%	Insufficient Data	15%	Insufficient Data	0.69	1.00	1.10	1.19	1.69	117.01	901.62	No UP
260-13[1]^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.36	1.09	1.35	2.75	2.82	0.00	739.30	No UP
277-14[2]^	7	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	No Data					20.03	0.00	No UP
377-15[2]^	34	1.18	1.21	1.16	82%	Insufficient Data	0%	Insufficient Data	No Data					10.14	9.29	No UP
77-16[1]*	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.22	1.12	1.54	3.52	5.65	0.00	0.00	No UP
40B-17[1]*	1	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.05	2.15	1.51	29.93	8.45	No Data		No UP
Weighted Corridor Average		1.32	1.20	1.45	54%	Insufficient Data	21%	Insufficient Data	0.50	1.24	1.18	2.46	2.25	957.0	289.9	17.87

SCALES

Performance Level	2 or 3 or 4 Lane Divided Highway					Uninterrupted			All	
Good/Above Average	< 0.77	< 44%	< 4%	< 16%	< 2%	> 0.77	< 1.15	< 1.3	< 44.18	> 16.5
Fair/Average	0.77 - 1.23	44% - 54%	4% - 7%	16% - 26%	2% - 4%	0.67 - 0.77	1.15 - 1.33	1.3 - 1.5	44.18-124.86	16.0 - 16.5
Poor/Below Average	> 1.23	> 54%	> 7%	> 26%	> 4%	< 0.67	> 1.33	> 1.5	> 124.86	< 16.0
Performance Level	**2 or 3 Lane Undivided Highway**					**Interrupted**				
Good/Above Average	< 0.94	< 51%	< 6%	< 19%	< 5%	> 0.33	< 1.3	< 3.0		
Fair/Average	0.94 - 1.06	51% - 58%	6% - 10%	19% - 27%	5% - 8%	0.17 - 0.33	1.3 - 2.0	3.0 - 6.0		
Poor/Below Average	> 1.06	> 58%	> 10%	> 27%	> 8%	< 0.17	> 2.0	> 6.0		
Performance Level	**4 or 5 Undivided Highway**									
Good/Above Average	< 0.80	< 42%	< 6%	< 6%	< 5%					
Fair/Average	0.80 - 1.20	42% - 51%	6% - 10%	6% - 9%	5% - 8%					
Poor/Below Average	> 1.20	> 51%	> 10%	> 9%	> 8%					

^Uninterrupted Flow Facility
*Interrupted Flow Facility

[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway

[1]Urban Operating Environment
[2]Rural Operating Environment

Notes: "Insufficient Data" indicates there was not enough data available to generate reliable performance ratings
"No UP" indicates no underpasses are present in the segment

NEEDS ASSESSMENT

Corridor Description

The SR 87/SR 260/SR 377 corridor is an important travel corridor in the central/northeastern part of the state. The corridor functions as a route for recreational, tourist, and regional traffic and provides critical connections between the communities it serves and the rest of the regional and interstate network.

Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP), 2010-2035. Statewide performance goals that are relevant to SR 87/SR 260/SR 377 performance areas were identified and corridor goals were then formulated for each of the five performance areas that aligned with the overall statewide goals established by the LRTP. Based on stakeholder input, corridor goals, corridor objectives, and performance results, three "emphasis areas" were identified for the SR 87/SR 260/SR 377 corridor: Mobility, Safety, and Freight.

Taking into account the corridor goals and identified emphasis areas, performance objectives were developed for each quantifiable performance measure that identify the desired level of performance based on the performance scale levels for the overall corridor and for each segment of the corridor. For the performance emphasis areas, the corridor-wide weighted average performance objectives are identified with a higher standard than for the other performance areas.

Achieving corridor and segment performance objectives will help ensure that investments are targeted toward improvements that support the safe and efficient movement of travelers on the corridor. Corridor performance is measured against corridor and segment objectives to determine needs – the gap between observed performance and performance objectives.

Needs Assessment Process

The performance-based needs assessment evaluates the difference between the baseline performance and the performance objectives for each of the five performance areas used to characterize the health of the corridor: Pavement, Bridge, Mobility, Safety, and Freight. The performance-based needs assessment process is illustrated in **Figure ES-4**.

The needs assessment compares baseline corridor performance with performance objectives to provide a starting point for the identification of performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process is shown in **Figure ES-5**.

The initial level of need for each segment is refined to account for hot spots and recently completed or under construction projects, resulting in a final level of need for each segment. The final levels of need for each primary and secondary performance measure are combined to produce a weighted final need rating for each segment. A detailed review of available data helps identify contributing factors to the need and if there is a high level of historical investment.

Figure ES-4: Needs Assessment Process

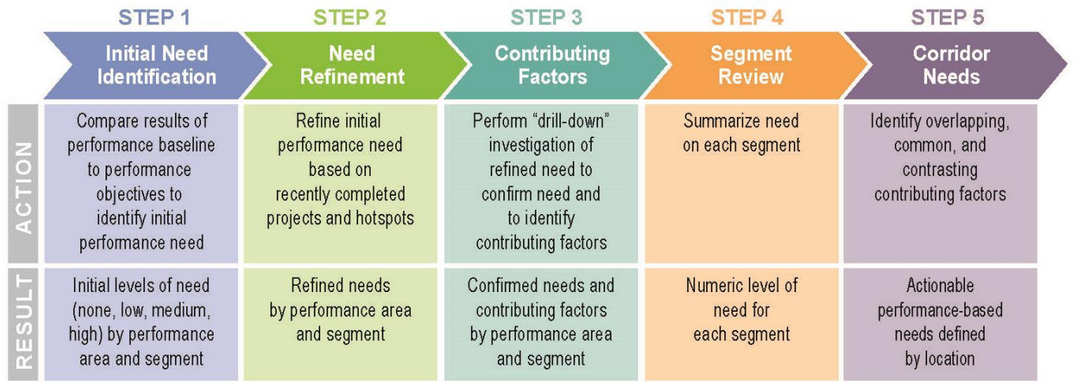


Figure ES-5: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)

Performance Thresholds	Performance Level	Initial Level of Need	Description
6.5	Good	None*	All levels of Good and top 1/3 of Fair (>6.0)
	Good		
	Good		
	Fair		
	Fair	Low	Middle 1/3 of Fair (5.5-6.0)
5.0	Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor (4.5-5.5)
	Poor		
	Poor	High	Lower 2/3 of Poor (<4.5)
	Poor		

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Summary of Needs

Table ES-3 provides a summary of needs for each segment across all performance areas, with the average need score for each segment presented in the last row of the table. A weighting factor of 1.5 is applied to the need scores of the performance areas identified as emphasis areas (Mobility, Safety, and Freight for the SR 87/SR 260/SR 377 corridor). There is one segment with a High average need (77-16), fourteen segments with a Medium average need, and two segments with a Low average need. More information on the identified final needs in each performance area is provided below.

Pavement Needs

- Seven segments (87-1, 87-3, 87-4, 260-12, 260-13, 277-14, and 77-16) contain Pavement hot spots, but one of these segments had recent paving projects that addressed the need
- Segments 87-1, 87-3, 87-4, and 40B-17 have final needs of Low and Segments 260-13 and 77-16 have final needs of Medium. Segment 277-14 is the only High need segment of the corridor; all other segments of the corridor have a final need of None

Bridge Needs

- Seven segments (87-6, 87-7, 260-8, 260-9, 277-14, 377-15, and 40B-17) do not include any bridges
- Segment 77-16 includes one bridge, the Little Colorado River Bridge, which is functionally obsolete
- There are no final Bridge needs along the corridor

Mobility Needs

- Low Mobility needs exist on fifteen of the seventeen segments of the corridor
- Two segments (260-9 and 77-16) have High final needs
- Segment 260-9 has high existing, directional, and future V/C needs
- Many segments contain Medium or High directional PTI needs
- Bicycle accommodation needs are High on ten of the seventeen segments of the corridor

Safety Needs

- High Safety needs exist on six of the seventeen segments
- Safety hot spots exist in Segments 87-4, 87-6, and 260-8
- Many of the segments of the corridor (87-7, 260-9, 260-11, 260-13, 277-14, 77-16, 40B-17) contain insufficient data to determine levels of need, so a need value is not available (N/A)

Freight Needs

- High Freight needs exist on eleven of the seventeen segments
- Many segments of the corridor contain High directional PTI and closure duration needs
- No Freight hot spots exist along the corridor
- Segments 277-14 and 377-15 have no data to determine a level of need

Overlapping Needs

This section identifies overlapping performance needs on the SR 87/SR 260/SR 377 corridor, which provides guidance to develop strategic solutions that address more than one performance area with elevated levels of need. Completing projects that address multiple needs presents the opportunity to more effectively improve overall performance. A summary of the overlapping needs that relate to locations with elevated levels of need is provided below:

- Segments 87-3, 87-4, 87-5, 87-6 and 260-12 all contain elevated needs in the Safety and Freight performance areas
- Segment 77-16, which has the highest average need score of all the segments of the corridor, has elevated needs in the Pavement, Mobility, and Freight performance areas
- Segment 260-9 contains elevated needs in the Mobility and Freight performance areas

Table ES-3: Summary of Needs by Segment

Performance Area	Segment Number and Mileposts (MP)																
	87-1	87-2	87-3	87-4	87-5	87-6	87-7	260-8	260-9	260-10	260-11	260-12	260-13	277-14	377-15	77-16	40B-17^
	MP 177-182	MP 182-191	MP 191-213	MP 213-235	MP 235-241	MP 241-250	MP 250-253	MP 252-256	MP 256-260	MP 260-277	MP 277-282	MP 282-304	MP 304-306	MP 306-313	MP 0-34	MP 386-389	MP 287-288
Pavement	Low	None	Low	Low	None	None	None	None	None	None	None	None	Medium	High	None	Medium	Low
Bridge	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Low	None
Mobility[+]	Low	Low	Low	Low	Low	Low	Low	Low	High	Low	Low	Low	Low	Low	Low	High	Low
Safety[+]	High	Low	High	High	Medium	High	N/A[#]	Low	N/A	Low	N/A	High	N/A	N/A	High	N/A	N/A
Freight[+]	Low	Low	High	High	High	High	Low	High	High	High	High	High	High	N/A	N/A	Medium	High
Average Need	**1.31**	**0.69**	**1.77**	**1.77**	**1.38**	**1.62**	**0.60**	**1.15**	**1.80**	**1.15**	**1.20**	**1.62**	**1.60**	**1.29**	**1.20**	**2.10**	**1.40**

** A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

[+] *Identified as an emphasis area for the SR 87/SR 260/SR 377 corridor.*

 # N/A indicates insufficient or no data available to determine level of need

^ Segment 40B-17 Pavement Need estimated based on field review

Average Need Scale	
None*	< 0.1
Low	0.1 - 1.0
Medium	1.0 - 2.0
High	> 2.0

STRATEGIC SOLUTIONS

The principal objective of the CPS is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State's key transportation corridors. One of the first steps in the development of strategic solutions is to identify areas of elevated levels of need as addressing these needs will have the greatest effect on corridor performance. Segments with Medium or High needs and specific locations of hot spots are considered strategic investment areas for which strategic solutions should be developed. Segments with lower levels of need or without identified hot spots are not considered candidates for strategic investment and are expected to be addressed through other ADOT programming processes. The SR 87/SR 260/SR 377 strategic investment areas (resulting from the elevated needs) are shown in **Figure ES-6**.

Screening Process

In some cases, needs that are identified do not advance to solutions development and are screened out from further consideration because they have been or will be addressed through other measures including:

- A project is programmed to address this need
- The need is a result of a Pavement or Bridge hot spot that does not show historical investment or rating issues; these hot spots will likely be addressed through other ADOT programming means
- A bridge is not a hot spot but is located within a segment with a Medium or High level of need; this bridge will likely be addressed through current ADOT bridge maintenance and preservation programming processes
- The need is determined to be non-actionable (i.e., cannot be addressed through an ADOT project)
- The conditions/characteristics of the location have changed since the performance data was collected that was used to identify the need

Candidate Solutions

For each elevated need within a strategic investment area that is not screened out, a candidate solution is developed to address the identified need. Each candidate solution is assigned to one of the following three P2P investment categories based on the scope of the solution:

- Preservation
- Modernization
- Expansion

Documented performance needs serve as the foundation for developing candidate solutions for corridor preservation, modernization, and expansion. Candidate solutions are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT's traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the SR 87/SR 260/SR 377 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

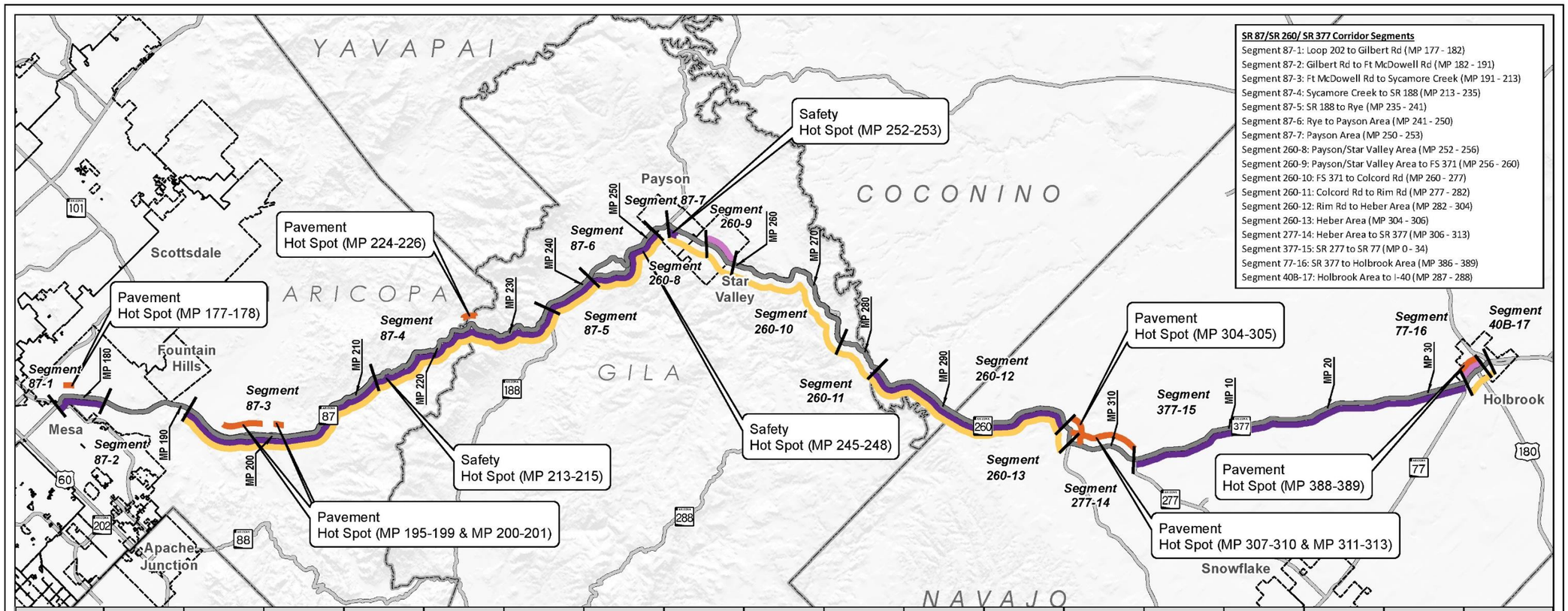
Candidate solutions include some or all of the following characteristics:

- Do not recreate or replace results from normal programming processes
- May include programs or initiatives, areas for further study, and infrastructure projects
- Address elevated levels of need (High or Medium) and hot spots
- Focus on investments in modernization projects (to optimize current infrastructure)
- Address overlapping needs
- Reduce costly repetitive maintenance
- Extend operational life of system and delay expansion
- Leverage programmed projects that can be expanded to address other strategic elements
- Provide measurable benefit

Candidate solutions developed to address an elevated need in the Pavement or Bridge performance areas include two options; rehabilitation or full replacement. These solutions are initially evaluated through a Life-Cycle Cost Analysis (LCCA) to provide insights into the cost-effectiveness of these options so a recommended approach can be identified. Candidate solutions developed to address an elevated need in the Mobility, Safety, or Freight performance areas are advanced directly to the Performance Effectiveness Evaluation. In some cases, there may be multiple solutions identified to address the same area of need.

Candidate solutions that are recommended to expand or modify the scope of an already programmed project are noted and are not advanced to solution evaluation and prioritization. These solutions are directly recommended for programming.

Figure ES-6: Strategic Investment Areas



Performance Area	87-1 MP 177-182	87-2 MP 182-191	87-3 MP 191-213	87-4 MP 213-235	87-5 MP 235-241	87-6 MP 241-250	87-7 MP 250-253	260-8 MP 252-256	260-9 MP 256-260	260-10 MP 260-277	260-11 MP 277-282	260-12 MP 282-304	260-13 MP 304-306	277-14 MP 306-313	377-15 MP 0-34	77-16 MP 386-389	40B-17^ MP 287-288	Performance Area
Pavement	Hot Spot	-	Hot Spot	Hot Spot	-	-	-	-	-	-	-	-	Medium	High	-	Medium	-	Pavement
Bridge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Bridge
Mobility*	-	-	-	-	-	-	-	-	High	-	-	-	-	-	-	High	-	Mobility*
Safety*	High	-	High	High	Medium	High	N/A#	Hot Spot	N/A	-	N/A	High	N/A	N/A	High	N/A	N/A	Safety*
Freight*	-	-	High	High	High	High	-	High	High	High	High	High	High	N/A	N/A	Medium	High	Freight*

* Identified as emphasis area for SR 87/SR 260/SR 377 Corridor

^40B-17 Pavement Need estimated bases on field review

N/A indicate insufficient or no data available to determine level of need

Note: Figure shows strategic investment areas, which are segments with Medium and High levels of need and locations of hot spots. A "-" symbol indicates a segment level of need of Low or None, which is not considered strategic

SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Strategic Investment Areas

Miles
0 9 18

Performance Area Needs

- Corridor Segment
- County Boundary
- Interstate/Highway
- City Boundary
- Pavement
- Mobility
- Safety
- Freight
- Bridge

Level of Need
Low
Medium
High

SOLUTION EVALUATION AND PRIORITIZATION

Candidate solutions are evaluated using the following steps: LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation is shown in Figure ES-7 and described more fully below.

Life-Cycle Cost Analysis

All Pavement and Bridge candidate solutions have two options: rehabilitation/repair or reconstruction. These options are evaluated through an LCCA to determine the best approach for each location where a Pavement or Bridge solution is recommended. The LCCA can eliminate options from further consideration and identify which options should be carried forward for further evaluation.

All Mobility, Safety, and Freight strategic investment areas that result in multiple independent candidate solutions are advanced directly to the Performance Effectiveness Evaluation.

Performance Effectiveness Evaluation

After completing the LCCA process, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Analysis to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

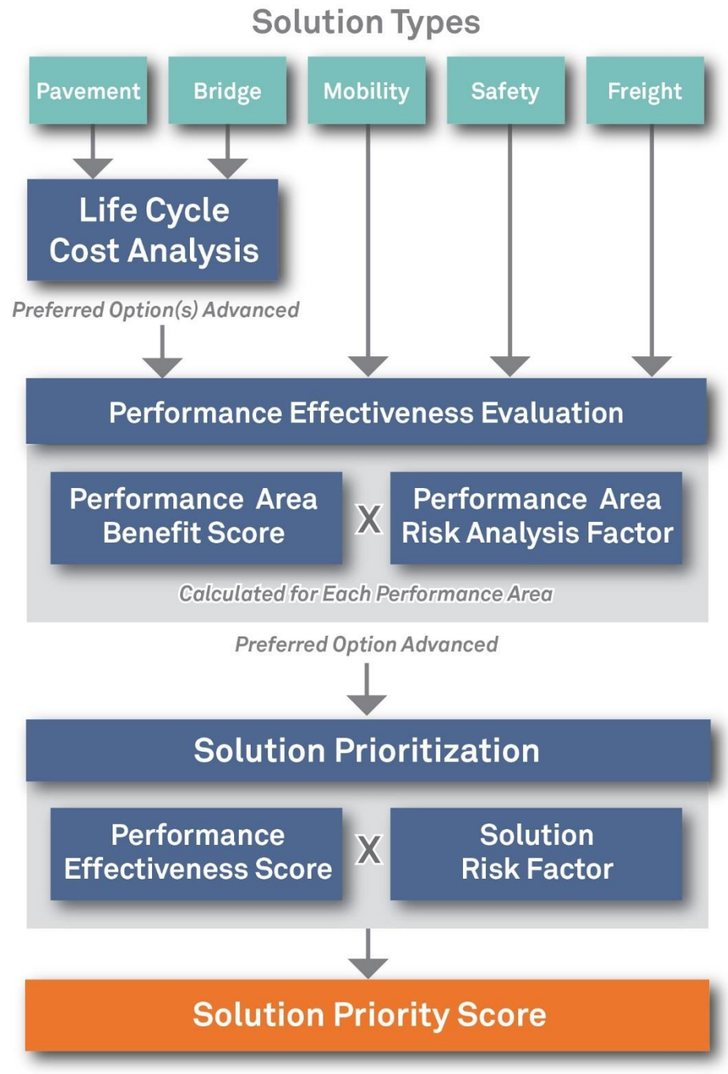
Solution Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Solution Risk Analysis process. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of the performance failure.

Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score. The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

Figure ES-7: Candidate Solution Evaluation Process



SUMMARY OF CORRIDOR RECOMMENDATIONS

Prioritized Candidate Solution Recommendations

Table ES-4 and **Figure ES-8** show the prioritized candidate solutions recommended for the SR 87/SR 260/SR 377 corridor. Implementation of these solutions is anticipated to improve performance of the SR 87/SR 260/SR 377 corridor, primarily in the Mobility, Safety, and Freight performance areas. The highest priority solutions address needs in the Rye area (SR 87 MP 235-241), Salt River area (SR 87 MP 177-182), and near the Payson area (SR 87 MP 246-251).

Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor recommendations can also be identified. These recommendations could include modifications to the existing Statewide Construction Program, areas for further study, or other corridor-specific recommendations that are not related to construction or policy. The list below identifies other corridor recommendations for the SR 87/SR 260/SR 377 corridor:

- Implement a driving impaired and speeding safety education campaign along the corridor
- Coordinate with the Arizona Game and Fish Department (AGFD) to conduct a study on vehicle/wildlife conflicts on SR 87 between MP 233 and 241
- Conduct an access management study on SR 87 and SR 260 through the Town of Payson

Policy and Initiative Recommendations

In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through the CPS process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on the SR 87/SR 260/SR 377 corridor, but across the entire state highway system where conditions are applicable. The following list, which is in no particular order of priority, was derived from the Round 1, Round 2, and Round 3 CPS:

- Install Intelligent Transportation System (ITS) conduit with all new infrastructure projects
- Prepare strategic plans for Closed Circuit Television (CCTV) camera and Road Weather Information System (RWIS) locations statewide
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic messaging signs (DMS), and call box locations to expand ITS applications across the state
- Consider solar power for lighting and ITS where applicable
- Investigate ice formation prediction technology where applicable
- Conduct highway safety manual evaluation for all future programmed projects
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects
- Develop standardized bridge maintenance procedures so districts can do routine maintenance work
- Review historical ratings and level of previous investment during scoping of pavement and bridge projects; in pavement locations that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project
- Expand programmed and future pavement projects as necessary to include shoulders
- Expand median cable barrier guidelines to account for safety performance
- Install CCTV cameras with all DMS
- In locations with limited communications, use CCTV cameras to provide still images rather than streaming video
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16.25 feet where feasible
- All new or reconstructed roadway/shoulder edges adjacent to an unpaved surface should be constructed with a Safety Edge
- Collision data on tribal lands may be incomplete or inconsistent; additional coordination for data on tribal lands is recommended to ensure adequate reflection of safety issues
- Expand data collection devices statewide to measure freight delay
- Evaluate and accommodate potential changes in freight and goods movement trends that may result from improvements and expansions to the state roadway network

Next Steps

Candidate solutions developed for the SR 87/SR 260/SR 377 corridor will be considered along with other candidate projects in the ADOT statewide programming process. It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related to the ultimate vision for the corridor that may have been defined in the context of prior planning studies and/or design concept reports. Recommendation from such studies are still relevant to addressing the ultimate corridor objectives.

Upon completion of all three CPS rounds, the results will be incorporated into a summary document comparing all corridors that is expected to provide a performance-based review of statewide needs and candidate solutions.

Table ES-4: Prioritized Recommended Solutions

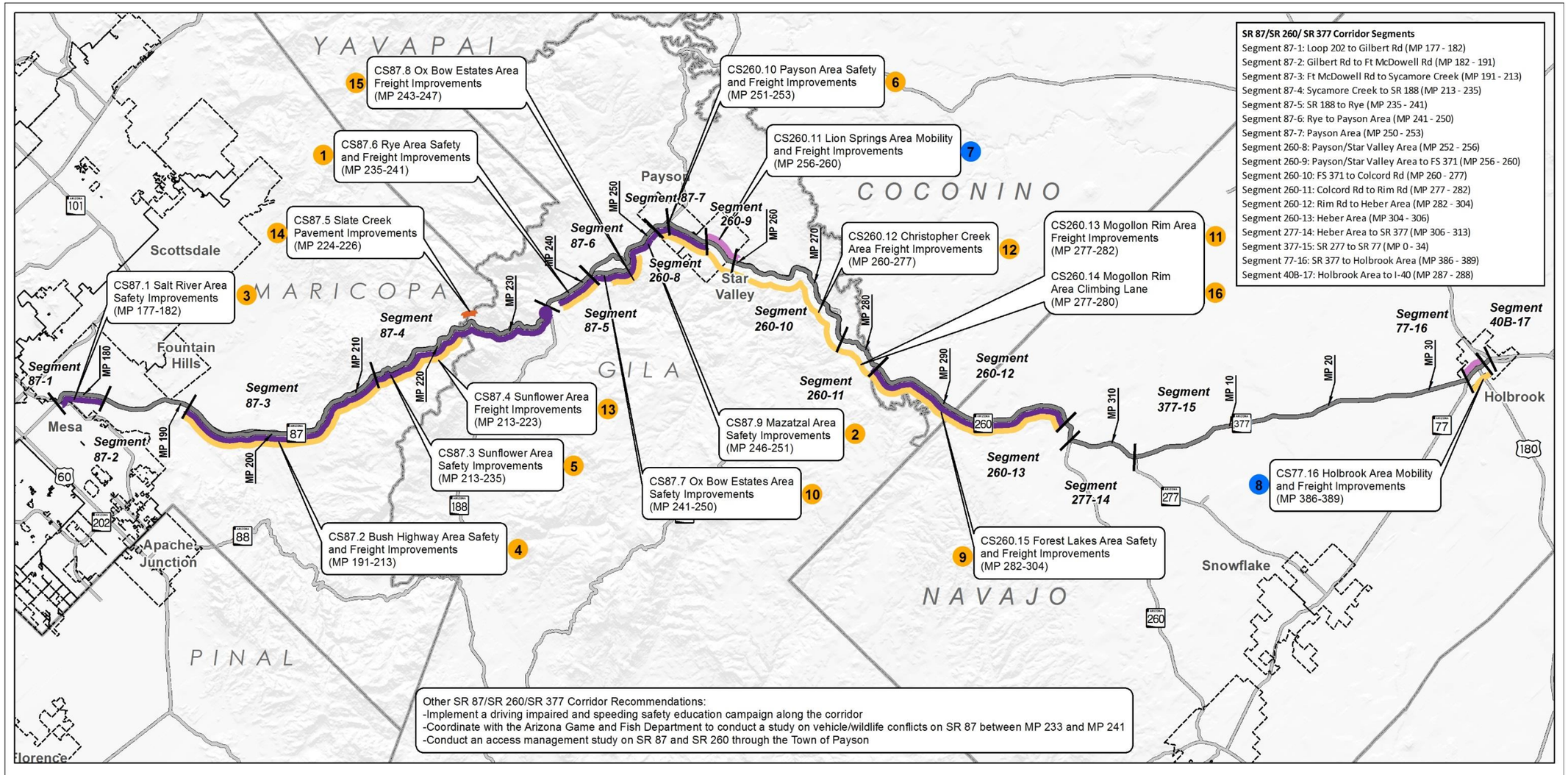
Rank	Candidate Solution #	Option*	Candidate Solution Name	Candidate Solution Scope	Estimated Cost (in millions)	Investment Category (Preservation [P] Modernization [M] Expansion [E])	Prioritization Score
1	CS87.6	-	Rye Area Safety and Freight Improvements (SR 87 MP 235-241)	-Install advisory sign about approaching area with intersections (Deer Creek Drive [MP 237.6], Gisela Road [MP 239.5], two intersections in Rye [MP 240.5 and MP 240.9]) -Install reduced speed advisory sign on SR 87 (NB MP 240, SB MP 241) -Install speed feedback signs (NB MP 240, SB MP 241) -On SR 188 approaching SR 87 add flashing beacons to WB stop sign	$0.2	M	261
2	CS87.9	-	Mazatzal Area Safety Improvements (SR 87 MP 246-251)	-Widen shoulders SB MP 246.2-250.9	$2.3	M	216
3	CS87.1	-	Salt River Area Safety Improvements (SR 87 MP 177-182)	-Install warning signs and chevrons on curved Salt River bridge approaches -Install raised pavement markers along the outside edge line -Install lighting at Oak St (MP 178.0), Center St (MP 179.1), Mesa Dr (MP 179.7), and Camelback Rd (MP 181.1) -Install raised concrete barrier in median on Salt River bridge and approaches (MP 177-177.5)	$4.7	M	212
4	CS87.2	-	Bush Highway Area Safety and Freight Improvements (SR 87 MP 191-213)	-Rehabilitate shoulders (NB/SB MP 194-205) -Install speed feedback signs (NB MP 206.5 and 207.7, NB/SB before curves and intersection with FR 68 [MP 209.6]) -Widen inside shoulders (SB MP 211-209)	$6.8	M	210
5	CS87.3	-	Sunflower Area Safety Improvements (SR 87 MP 213-235)	-Install speed feedback signs and speed advisory warning signs with flashing beacons at curves (NB MP 213.2, 214.0, 217.8, 220.5, 224.5, 232.5; SB MP 231.0, 229.3, 221.0, 219.6, 216.0, 214.3) -Rehabilitate shoulders -Widen inside shoulders (SB MP 228.5-226.0) -Install rock-fall mitigation (NB MP 214.2-214.6; SB MP 228.9-228.7, 228.5-228.0, 217.6-218.0)	$18.3	M	189
6	CS260.10	-	Payson Area Safety and Freight Improvements (SR 87 MP 251-SR 260 MP 253)	-Implement signal coordination/adaptive control for six signals in Payson urban area (SR 87/SR 260 intersection, SR 260/Payson Village Center, SR 260/Manzanita Dr, SR 87/Main St, SR 87/Bonita St, and SR 87/Green Valley Parkway [BIA101]) -Implement protected/permitted left-turn phasing at SR 87/Manzanita Dr intersection (NB and SB approaches) and provide advance signal advisory sign with flashing beacons WB on SR 260	$0.4	M	171
7	CS260.11	-	Lion Springs Area Mobility and Freight Improvements (SR 260 MP 256-260)	-Reconstruct to 4-lane divided highway (using the existing 2-lane road for one direction) [Design already programmed for FY 2021 in ADOT 5-year program]	$50.0	E	160
8	CS77.16	C	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77) (SR 77 MP 386-389)	-Construct new roadway connection between SR 377/SR 77 and I-40/40B West TI (Exit 285) west of Holbrook; includes new bridge over the Little Colorado River and overpass at railroad crossing	$43.8	E	136
		A	*Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)* (SR 77 MP 386-389)	*-Construct new roadway connection between US 180/SR 77 and I-40/40B West TI (Exit 285) west of Holbrook; includes new bridge over the Little Colorado River and overpass at railroad crossing*	*$92.1*	*E*	*67*
		B	*Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)* (SR 77 MP 386-389)	*-Construct overpass at at-grade railroad crossing and new bridge over the Little Colorado River adjacent to existing SR 77 alignment* *-Remove existing Little Colorado River Bridge*	*$75.8*	*E*	*46*
9	CS260.15	-	Forest Lakes Area Safety and Freight Improvements (SR 260 MP 282-304)	-Widen shoulders -Construct alternating passing lanes (varying locations for 11 miles of the segment)	$56.5	M	130
10	CS87.7	-	Ox Bow Estates Area Safety Improvements (SR 87 MP 241-250)	-Install speed feedback signs and speed advisory warning signs with flashing beacons at curves (SB MP 247, MP 245) -Implement variable speed limits MP 241-246 with new DMS and CCTV SB at MP 247 and new DMS and CCTV NB at MP 240 -Install RWIS at MP 245 with dynamic weather warning beacons	$4.1	M	123
11	CS260.13	-	Mogollon Rim Area Freight Improvements (SR 260 MP 277-282)	-Install centerline rumble strips -Install rock-fall mitigation (WB MP 278.4-278.6, 279.8-280.9, 281.4-282.0) -Install RWIS at MP 282 with dynamic weather warning beacons -Implement variable speed limits at MP 277-282 and new DMS and CCTV at MP 282 WB	$9.5	M	12

Table ES-4: Prioritized Recommended Solutions (continued)

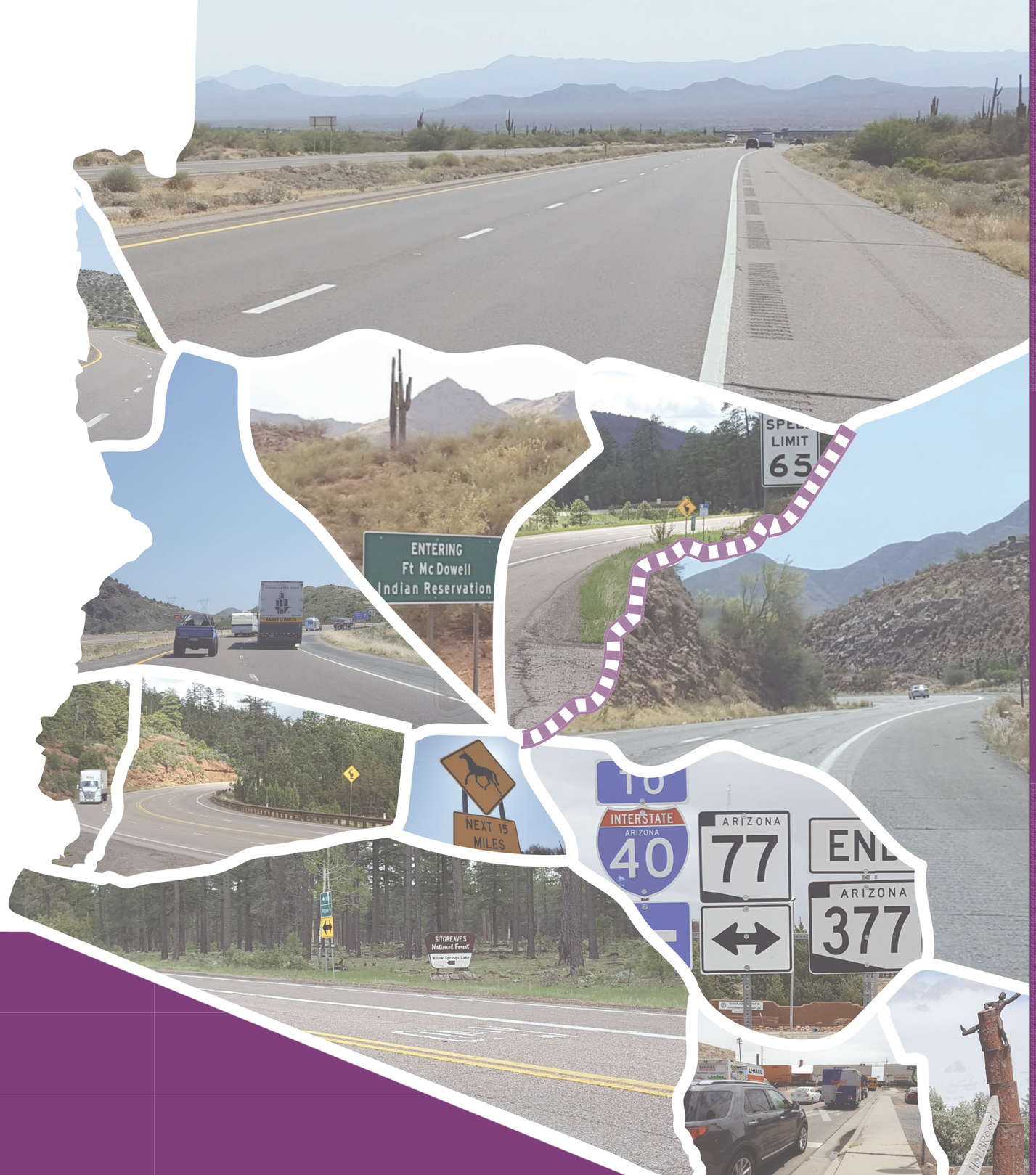
Rank	Candidate Solution #	Option*	Candidate Solution Name	Candidate Solution Scope	Estimated Cost (in millions)	Investment Category (Preservation [P] Modernization [M] Expansion [E])	Prioritization Score
12	CS260.12	-	Christopher Creek Area Freight Improvements (SR 260 MP 260-277)	-Install rock-fall mitigation (WB MP 262.2-262.6, 261.6-261.9, 269.0-269.1, 269.7-269.8, 271.3-271.5; EB MP 269.8-269.9, 272.6-272.7) -Implement variable speed limits at MP 272-277 and new DMS and CCTV at MP 272 EB	$7.2	M	11
13	CS87.4	-	Sunflower Area Freight Improvements (SR 87 MP 213-223)	-Construct NB climbing lane, MP 213-215 and MP 219-223 -Widen Whiskey Springs Bridge, #2515 MP 220.32 -Widen Upper Kitty Joe Bridge, #2497 MP 221.39	$43.4	M	10
14	CS87.5	-	Slate Creek Pavement Improvements (SR 87 MP 224-226)	-Replace Pavement	$7.2	M	9
15	CS87.8	-	Ox Bow Estates Area Freight Improvements (SR 87 MP 243-247)	-Construct NB climbing lane	$22.4	M	2
16	CS260.14	-	Mogollon Rim Area Climbing Lane (SR 260 MP 277-280)	-Construct EB climbing lane	$16.8	M	1

* '-' indicates only one solution is being proposed and no options are being considered

Figure ES-8: Prioritized Recommended Solutions



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Prioritized Recommended Solutions



Final Report

1.0 INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of State Route 87 (SR 87)/State Route 260 (SR 260)/State Route 377 (SR 377) between Junction State Route 202L (Loop 202) and Junction Interstate 40 (I-40). The study examines key performance measures relative to the SR 87/SR 260/SR 377 corridor, and the results of this performance evaluation are used to identify potential strategic improvements. The intent of the corridor profile program, and of ADOT's Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT is conducting eleven CPS within three separate groupings.

The first three studies (Round 1) began in Spring 2014, and encompass:

- I-17: SR 101L to I-40
- I-19: Nogales to I-10
- I-40: California State Line to I-17

The second round (Round 2) of studies, initiated in Spring 2015, includes:

- I-8: California State Line to I-10
- I-40: I-17 to the New Mexico State Line
- SR 95: I-8 to I-40

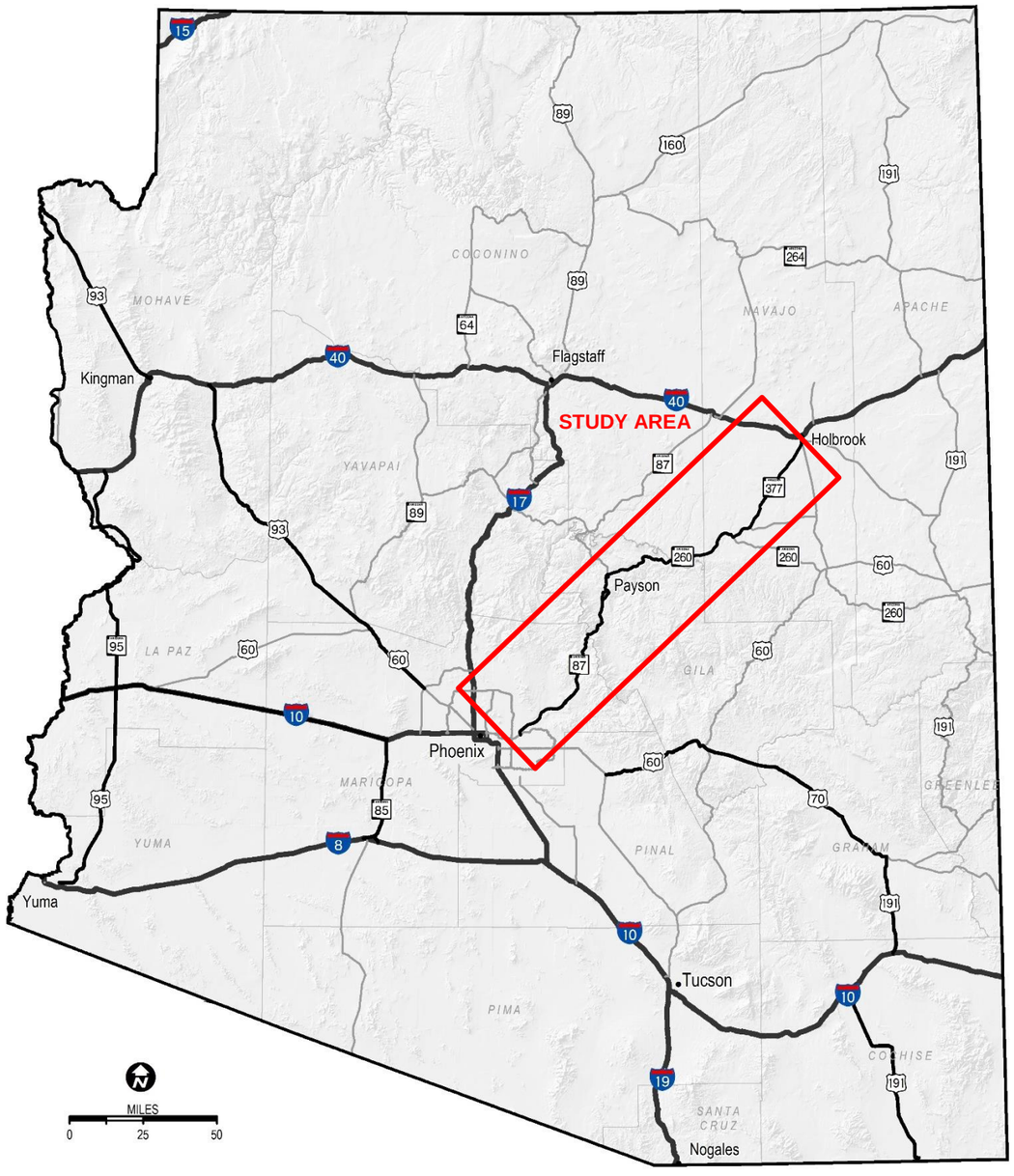
The third round (Round 3) of studies, initiated in Fall 2015, includes:

- I-10: California State Line to SR 85 and SR 85: I-10 to I-8
- I-10: SR 202L to the New Mexico State Line
- SR 87/SR 260/SR 377: SR 202L to I-40
- US 60/US 70: SR 79 to US 191 and US 191: US 70 to SR 80
- US 93/US 60: Nevada State Line to SR 303L

The studies under this program assess the overall health, or performance, of the state's strategic highways. The CPS will identify candidate solutions for consideration in the Multimodal Planning Division's (MPD) P2P project prioritization process, providing information to guide corridor-specific project selection and programming decisions.

The SR 87/SR 260/SR 377 corridor, depicted in **Figure 1,** is one of the strategic statewide corridors identified and the subject of this Round 3 CPS.

Figure 1: Corridor Study Area



1.1 Corridor Study Purpose

The purpose of the CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation, accounting for performance effectiveness and risk analysis findings

1.2 Study Goals and Objectives

The objective of this study is to identify a recommended set of prioritized potential solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The SR 87/SR 260/SR 377 CPS defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance. Corridor benefits can be categorized by the following three investment types:

- Preservation: Activities that protect transportation infrastructure by sustaining asset condition or extending asset service life
- Modernization: Highway improvements that upgrade efficiency, functionality, and safety without adding capacity
- Expansion: Improvements that add transportation capacity through the addition of new facilities and/or services

This study identifies potential actions to improve the performance of the SR 87/SR 260/SR 377 corridor. Proposed actions are compared based on their likelihood of achieving desired performance levels, life-cycle costs, cost-effectiveness, and risk analysis to produce a prioritized list of solutions that help achieve corridor goals.

The following goals are identified as the desired outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

1.3 Corridor Overview and Location

The SR 87/SR 260/SR 377 corridor between Loop 202 and I-40 provides movement for freight, tourism, and recreation needs within Arizona. It provides a key link between the Phoenix metropolitan area and the northeast region of the state and serves intrastate, interstate, and international commerce. The corridor connects Mesa, Fountain Hills, Payson, Heber-Overgaard and Holbrook as well as the Salt River Pima Maricopa Indian Community (SRPMIC), Fort McDowell-Yavapai, and Tonto Apache tribes. This corridor also serves a number of recreational areas and National Forests. The SR 87/SR 260/SR 377 corridor includes portions of SR 87, SR 260, SR 277, SR 377, SR 77 and I-40 Business Route (40B). The SR 87/SR 260/SR 377 corridor between Loop 202 and I-40 is approximately 175 miles in length.

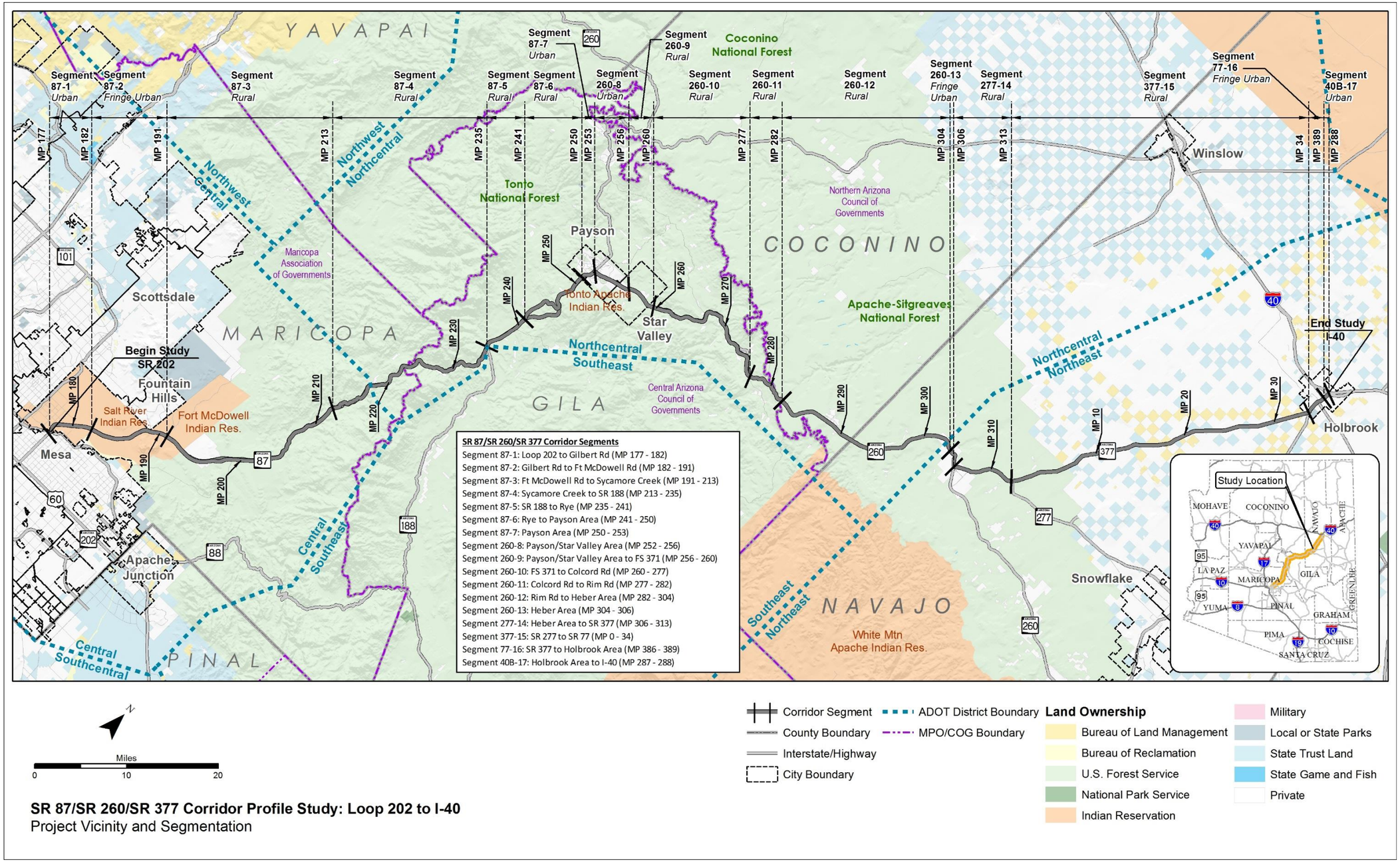
1.4 Corridor Segments

The SR 87/SR 260/SR 377 corridor is divided into 17 planning segments to allow for an appropriate level of detailed needs analysis, performance evaluation, and comparison between different segments of the corridor. The corridor is segmented at logical breaks where the context changes due to differences in characteristics such as terrain, daily traffic volumes, or roadway typical sections. Corridor segments are described in **Table 1** and shown in **Figure 2**.

Table 1: SR 87/SR 260/SR 377 Corridor Segments

Segment #	Route	Begin	End	Approx. Begin Milepost	Approx. End Milepost	Approx. Length (miles)	Typical Through Lanes (NB/EB, SB/WB)	2014/2035 Average Annual Daily Traffic Volume (vpd)	Character Description
87-1	SR 87	Loop 202	Gilbert Rd	177	182	5	2,2	15,116/29,291	This segment has interrupted flow, numerous access points, consistent traffic volumes, a five-lane undivided or four-lane divided section, and is located in the Phoenix metropolitan urban area.
87-2	SR 87	Gilbert Rd	Fort McDowell Rd	182	191	9	2,2	15,450/34,330	This segment has interrupted flow characteristics, access points, consistent traffic volumes, a four-lane divided section, and is located in the fringes of the Phoenix metropolitan urban area.
87-3	SR 87	Fort McDowell Rd	Sycamore Creek	191	213	22	2,2	9,827/20,289	This rural four-lane divided segment with uninterrupted flow has consistent topography and traffic volumes.
87-4	SR 87	Sycamore Creek	SR 188	213	235	22	2,2	10,778/14,624	This rural four-lane divided segment with uninterrupted flow has steep terrain and a curvy alignment.
87-5	SR 87	SR 188	Rye	235	241	6	2,2	11,717/9,852	This rural four-lane divided segment with uninterrupted flow has flatter terrain than surrounding segments.
87-6	SR 87	Rye	Green Valley Pkwy/BIA 101	241	250	9	2,2	11,717/11,151	This rural segment with uninterrupted flow is a climbing four-lane divided section.
87-7	SR 87	Green Valley Pkwy/BIA 101	SR 260	250	253	3	2,2	19,185/31,821	This segment has interrupted flow, numerous access points, is comprised of a five-lane undivided section, and is located in the Payson urban area.
260-8	SR 260	SR 87	Mayfield Canyon Rd	252	256	4	2,2	14,233/23,706	This segment is comprised of a five-lane undivided section. It is located in the Payson/Star Valley urban area.
260-9	SR 260	Mayfield Canyon Rd	FS 371	256	260	4	1,1	13,796/21,891	This rural segment with uninterrupted flow is comprised of a two-lane undivided section.
260-10	SR 260	FS 371	Colcord Rd	260	277	17	2,2	6,270/5,766	This rural segment with uninterrupted flow is comprised of a four-lane divided section. It is a climbing section.
260-11	SR 260	Colcord Rd	Rim Rd	277	282	5	2,2	6,112/7,752	This rural segment with uninterrupted flow is comprised of a four-lane undivided section. It includes a climbing section to the top of Mogollon Rim.
260-12	SR 260	Rim Rd	Black Canyon Ln	282	304	22	1,1	5,954/7,172	This rural segment with uninterrupted flow is comprised of a two-lane undivided section.
260-13	SR 260	Black Canyon Ln	SR 277	304	306	2	2,2	7,627/9,164	This segment with uninterrupted flow is comprised of a five-lane undivided section. It is located in the fringes of the Heber-Overgaard urban area.
277-14	SR 277	SR 260	SR 377	306	313	7	1,1	1,082/1,514	This rural segment with uninterrupted flow is a two-lane undivided section.
377-15	SR 377	SR 277	SR 77	0	34	34	1,1	2,091/2,701	This rural segment with uninterrupted flow is a two-lane undivided section.
77-16	SR 77	SR 377	I-40B	386	389	3	1,1	7,694/13,573	This segment has interrupted flow, numerous access points, a two-lane or four-lane undivided section, and is located in the fringes of the Holbrook urban area.
40B-17	I-40B	SR 77	I-40/Navajo Blvd TI	287	288	1	2,2	10,996/18,620	This segment has interrupted flow, numerous access points, a four-lane or five-lane undivided section, and is located in the Holbrook urban area.

Figure 2: Corridor Location and Segments



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Project Vicinity and Segmentation

1.5 Corridor Characteristics

The SR 87/SR 260/SR 377 corridor is an important travel corridor in the central/northeastern part of the state. The corridor functions as a route for recreational, tourist, and regional traffic and provides critical connections between the communities it serves and the rest of the regional and interstate network.

National Context

The SR 87/SR 260/SR 377 corridor is a strategic transportation link across central/northeastern Arizona for freight and intercity travel. The SR 87/SR 260/SR 377 corridor also functions as an alternate route to I-40/I-17 when either of those facilities is closed due to adverse weather or incidents.

Regional Connectivity

The SR 87/SR 260/SR 377 corridor between Loop 202 and I-40 provides movement for freight, tourism, and recreation needs within Arizona. The corridor is located in three ADOT Districts (Central, Northcentral, and Northeast); three planning areas (Maricopa Association of Governments [MAG], Central Arizona Government [CAG], and Northern Arizona Council of Governments [NACOG]); and four counties (Maricopa, Gila, Coconino, and Navajo). Within the corridor study limits, SR 87/SR 260/SR 377 offers connections to several major roadways, including Loop 202, Bush Highway, SR 188, SR 87, SR 260, SR 277, SR 77, I-40B, and I-40. This corridor serves Arizona cities and towns including Mesa, Fountain Hills, Payson, Heber-Overgaard, and Holbrook as well as SRPMIC, Fort McDowell-Yavapai, and Tonto Apache tribes.

Commercial Truck Traffic

Communities along the SR 87/SR 260/SR 377 corridor are dependent on the corridor to access the state economy through freight deliveries and travel to other locations. Freight traffic (trucks) comprise from 2% to 12% of the total traffic flow on the corridor, with the higher truck percentages within the SR 87 portion of the corridor.

Commuter Traffic

A majority of the commuter traffic along the SR 87/SR 260/SR 377 corridor occurs within the urbanized areas of Mesa, Payson, and Holbrook. These areas are economic centers along what is considered mostly a rural combination of state routes. According to the most recent traffic volume data maintained by ADOT, traffic volumes range from approximately 1,200 vehicles per day on SR 277 and SR 377 portions of the corridor to approximately 19,000 vehicles per day in the Town of Payson area on SR 87 and SR 260.

According to the 2013 American Community Survey data from the US Census Bureau, 86% of the workforce in areas along the corridor relies on a private vehicle to get to work.

Recreation and Tourism

SR 87/SR 260/SR 377 provides access to many Arizona attractions such as state parks, national forests, and other recreational activities.

SR 87/SR 260/SR 377 provides access to the Tonto National Forest and Apache-Sitgreaves National Forest. Other recreational destinations accessible from the SR 87/SR 260/SR 377 corridor include Petrified Forest National Park (via I-40 near Holbrook), Roosevelt Lake (via SR 188), and Tonto Natural Bridge State Park (via SR 87 north of Payson), to name a few.

Multimodal Uses

Freight Rail

The BNSF Railway, one of the top transporters of intermodal freight in North America, crosses through the City of Holbrook. The BNSF "Transcon Corridor" connects Los Angeles with Chicago and passes through northern Arizona, paralleling I-40. The BNSF Transcon Corridor typically carries up to about 120 trains per day. The BNSF Railway currently interchanges with a short line railroad, the Apache Railway, in Holbrook. The Apache Railway, which is no longer in service, terminates in Holbrook and travels southward, and was primarily used for paper and mining products[1].

Passenger Rail

Amtrak's Southwest Chief Chicago to Los Angeles route primarily serves long-distance tourist travel, with daily service. The Southwest Chief shares track on the BNSF Transcon Corridor and is subject to delays caused by freight traffic. It travels at an average speed of 63 miles per hour across the State. There is no passenger station in Holbrook. The nearest passenger stations are in Winslow, Arizona and Gallup, New Mexico.

Bicycles/Pedestrians

Opportunities for bicycle and pedestrian travel are limited on SR 87/SR 260/SR 377. Bicycle traffic is permitted on the mainline outside shoulder; however, outside shoulder widths are relatively narrow and often less than the preferred 4-foot minimum width. SR 87, from milepost (MP) 182 to MP 250, has wider outside shoulders that are approximately 10 feet wide.

Bus/Transit

Valley Metro, the transit service for the Greater Phoenix Metropolitan area, offers two express bus routes near the southern terminus of the corridor in nearby Scottsdale and Mesa. The White Mountain Connection offers bus service from Holbrook to smaller communities south such as Snowflake, Taylor, Show Low, and Pinetop-Lakeside, along with stops at the Navajo County Government offices and Northland Pioneer College campuses. Greyhound operates intercity bus transit along I-40 in Arizona, with a stop in Holbrook.

[1] Source: Arizona State Rail Plan (2011), Appendix A

Aviation

There are two general aviation facilities in proximity to the SR 87/SR 260/SR 377 corridor. These include the Holbrook Municipal Airport, owned and operated by the City of Holbrook, and the Payson Municipal Airport, owned and operated by the Town of Payson. The southern portion of the corridor serves as a connection to numerous other airports located in the Phoenix Metropolitan area (via Loop 202).

Land Ownership, Land Uses and Jurisdictions

As shown previously in **Figure 2**, the SR 87/SR 260/SR 377 corridor traverses multiple jurisdictions and land owned or managed by various entities in four Arizona counties: Maricopa, Gila, Coconino, and Navajo. The southern section of the corridor traverses the SRPMIC and Fort McDowell Indian reservation lands. A majority of the corridor (from approximately SR 87 MP 195 to SR 377 MP 5) traverses Tonto and Apache-Sitgreaves National Forest land. Land ownership in and surrounding the Payson and Holbrook urban areas is mainly private, with the northern section of the corridor (SR 377 and SR 77) traversing a mix of private land, State Trust Land, and Bureau of Land Management (BLM) land.

Population Centers

Population centers of various sizes exist along the SR 87/SR 260/SR 377 corridor. **Table 2** provides a summary of the populations for communities along the corridor. Moderate population growth is projected between 2010 and 2040 in the major population centers along the corridor according to the Arizona State Demographer's Office.

Table 2: Current and Future Population

Community	2010 Population	2015 Population	2040 Population	% Change 2010-2040	Total Growth
Maricopa County	3,824,058	4,076,438	6,030,950	58%	2,206,892
Mesa	439,929	460,950	597,200	36%	157,271
Fountain Hills	22,444	23,346	30,400	35%	7,956
Gila County	53,565	54,406	54,531	2%	966
Payson	15,270	15,675	17,095	12%	1,825
Star Valley	2,303	2,325	2,252	-2%	-51
Navajo County	107,677	109,671	120,094	12%	12,417
Heber-Overgaard	2,829	2,930	3,395	20%	566
Holbrook	5,055	5,094	5,606	11%	551

Source: Arizona Department of Administration – Employment and Population Statistics

Major Traffic Generators

The Phoenix Metropolitan area, along with the Town of Payson and City of Holbrook, are major traffic generators for the SR 87/SR 260/SR 377 corridor.

Tribes

A southern portion of the corridor traverses the SRPMIC (SR 87/202L Junction to SR 87 MP 188) and Fort McDowell-Yavapai (SR 87 MP 188 to SR 87 MP 193) Indian reservations. The Yavapai Tonto Apache Reservation is immediately adjacent to SR 87 near the southern portion of the Town of Payson (SR 87 MP 251). The Navajo and White Mountain Apache Reservations are in the vicinity of the northern portion of the corridor but not immediately adjacent to it.

Wildlife Linkages

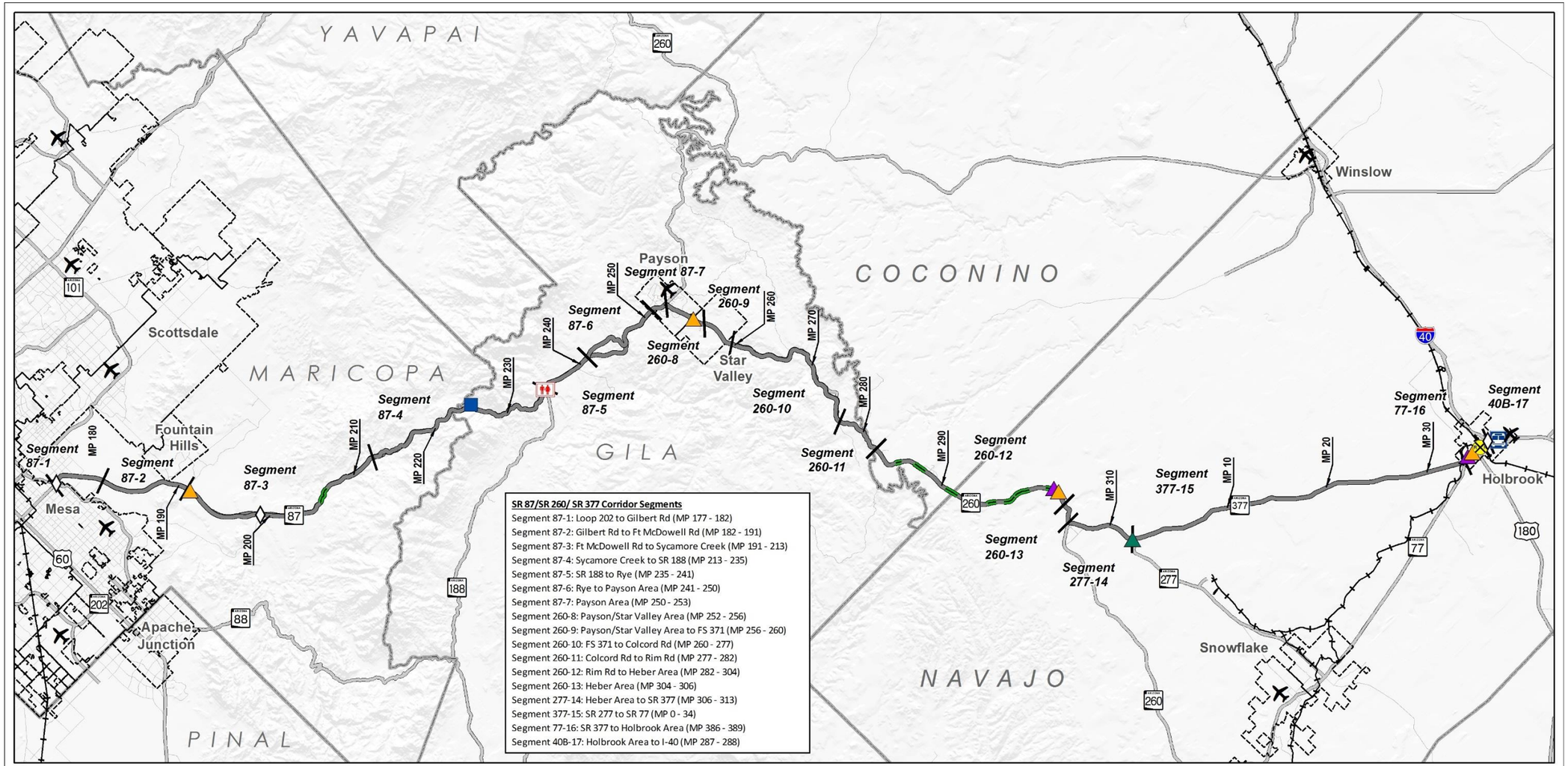
The Arizona State Wildlife Action Plan (SWAP) provides a 10-year vision for the entire state, identifying wildlife and habitats in need of conservation, insight regarding the stressors to those resources, and actions that can be taken to alleviate those stressors. Using the Habimap Tool that creates an interactive database of information included in the SWAP, the following were identified in relation to the SR 87/SR 260/SR 377 corridor:

- Arizona Game and Fish Department (AGFD) Wildlife Waters are scattered near the corridor, specifically in the areas south of Payson, near Heber-Overgaard, and along SR 377
- Arizona Important Bird Areas: The southern portion of the corridor is near the Salt and Verde Riparian Ecosystem Important Bird Area
- The corridor travels through allotments controlled by the Arizona State Land Department (ASLD), BLM, and United States Forest Service
- Riparian areas include a few areas adjacent to SR 87 MP 207-224 and MP 230-245, numerous crossings along SR 260, SR 77, and SR 377, and along parts of I-40B
- Arizona Wildlife Linkages: No missing linkages are noted, but there are potential Arizona Wildlife Linkage Zones along SR 87 from MP 215 to MP 235, along SR 260 from MP 253 to MP 302, and from SR 377 MP 6 to the northern terminus of the corridor in Holbrook on I-40B
- According to the Species and Habitat Conservation Guide (SHCG), sensitive habitats that have moderate to high conservation potential exist along the corridor; these areas are located south of the Town of Payson and between Payson and Holbrook
- Areas where Species of Greatest Conservation Need (SGCN) are high or moderately vulnerable are similar to the areas identified in the SHCG (see above)
- Identified areas of moderate or high levels of Species of Economic and Recreational Importance are in the vicinity of SR 87, from approximately MP 195 to MP 245, and along SR 260 from approximately MP 253 to MP 302

Corridor Assets

Corridor transportation assets are summarized in **Figure 3**. There are six passing lanes on the SR 260 portion of the corridor between MP 285 and MP 305. There is one climbing lane on SR 87 SB at approximately MP 205. The corridor includes three grade-separated traffic interchanges (TI): one interchange involving SR 87 and Bush Highway at approximately MP 199, one at the southern terminus of the corridor involving SR 87 and 202L, and one at the northern terminus of the corridor involving I-40B and I-40.

Figure 3: Corridor Assets



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Corridor Transportation Assets
2015 Data

Other assets include a rest area (Mazatzal Rest Area SR 87 EB MP 235.7, currently closed); dynamic message signs (DMS) located at SR 87 NB, MP 191.2; SR 260 EB, MP 255.0; SR 260 EB/WB, MP 302.4; and SR 77 SB, MP 387.5; and permanent traffic counters located at SR 87 MP 183, SR 87 MP 235, SR 260 MP 260, and SR 377 MP 30. There is a Road Weather Information System (RWIS) device located at the SR 277 and SR 377 intersection and a truck escape ramp on SR 87 NB near MP 227. Closed-circuit television (CCTV) cameras are located at SR 260 EB/WB, MP 302.4 and SR 77 NB/SB, MP 387.5.

1.6 Corridor Stakeholders and Input Process

A Technical Advisory Committee (TAC) was created that was comprised of representatives from key stakeholders. TAC meetings were held at key milestones to present results and obtain feedback. In addition, several meetings were conducted with key stakeholders between February 2016 and October 2016 to present the results and obtain feedback.

Key stakeholders identified for this study included:

- ADOT Northcentral District
- ADOT Northwest District
- ADOT Central District
- ADOT Technical Groups
- MAG
- NACOG
- CAG
- AGFD
- ASLD
- Federal Highway Administration (FHWA)

Several Working Papers were developed during the course of the CPS. The Working Papers were provided to the TAC for review and comment.

1.7 Prior Studies and Recommendations

This study identified recommendations from previous studies, plans, and preliminary design documents. Studies, plans, and programs pertinent to the SR 87/SR 260/SR 377 corridor were reviewed to understand the full context of future planning and design efforts within and around the study area. These studies are organized below into four categories: Framework and Statewide Studies, Regional Planning Studies, Planning Assistance for Rural Areas (PARAs) and Small Area Transportation Studies (SATS), and Design Concept Reports (DCRs) and Project Assessments (PAs).

Framework and Statewide Studies

- ADOT 2017-2021 Five-Year Transportation Facilities and Construction Program
- ADOT Statewide Bicycle and Pedestrian Plan Update
- ADOT Climbing and Passing Lane Prioritization Study
- Arizona Key Commerce Corridors
- Arizona Multimodal Freight Analysis Study
- Arizona Roadway Departure Safety Implementation Plan
- Arizona State Rail Plan
- Arizona Statewide Dynamic Message Sign (DMS) Master Plan
- Arizona Statewide Rail Framework Study
- Arizona Statewide Travel Demand Model (AZTDM)
- Arizona Wildlife Action Plan/Arizona Wildlife Linkages Assessment
- Building a Quality Arizona (BQAZ)
- What Moves You Arizona? LRTP 2010-2035

Regional Planning Studies

- MAG, 2035 Regional Transportation Plan
- CAG, 10-Year Transportation Improvement Plan
- NACOG, 10-Year Transportation Improvement Program

Planning Assistance for Rural Areas and Small Area Transportation Studies

- Gila County Transportation Study (2014)
- Payson Small Area Transportation Study (2011)
- SRPMIC 2010 LRTP
- Navajo County Central Region Transportation Study (2010)

Design Concept Reports and Project Assessments

- SR 87: New Four Peaks Road to Dos S Ranch – Final DCR (2008)
- SR 87: MP 224 to 226, Mt. Ord to Slate Creek Final PA (2012)
- SR 260: Wildlife-Vehicle Collision Mitigation for Safer Wildlife Movement across Highways (2012)
- SR 260: MP 282.49 to 305.90, Rim Road to Gibson Road Final PA (2014)
- SR 260: Payson to Heber, Location/DCR (May 2000)
- SR 377: HES Evaluation – Accident Analysis, MP 0 – MP 33.8 (2005)
- SR 377: SR 277-Holbrook Initial PA (2007)
- Road Safety Assessment (RSA): SR 87 MP 252.3 to 252.9, SR 260 MP 251.9 to 252.3 (2010)

Summary of Prior Recommendations

Various studies and plans, including several DCRs, have recommended improvements to the SR 87/SR 260/SR 377 corridor as shown in **Table 3** and **Figure 4**. They include, but are not limited to:

- Widening of numerous sections of SR 87/SR 260/SR 377, some of which will require right-of-way acquisition; many other proposed improvements are associated with the recommended widening:
  - Adding one general purpose lane in each direction on SR 87 from MP 177 to MP 253
  - Adding one general purpose lane in each direction on SR 260 from MP 256 to MP 260
  - Adding one general purpose lane in each direction on SR 277 from MP 306 to MP 313
  - Adding one general purpose lane in each direction on SR 377 from MP 0 to MP 34
  - Adding one general purpose lane in each direction on SR 77 from MP 386 to MP 389
- Climbing and passing lanes have been recommended throughout the SR 87/SR 260/SR 377 corridor based on the Climbing and Passing Lane Prioritization Study
- Many intersections within the Town of Payson on SR 87 or SR 260 have recommendations for studies to be performed or recommendations from previous studies that should be implemented
- Constructing alternative routes to the Payson and Holbrook urban areas has been recommended

Table 3: Corridor Recommendations from Previous Studies

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization[M], Expansion [E])			Status of Recommendation			Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)?	
SR 87											
1	177	253	76	Widen/upgrade SR 87 to 6 lanes			√		N/A	N	BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010)
2	180 181 183 188 201	180 181 183 188 201	-	Construct Dynamic Message Sign		√			N/A	N	Arizona Statewide Dynamic Message Sign Master Plan (2011)
3	224	226	1	Construct landslide mitigation measures	√				N/A	N	SR 87, MP 224 to MP 226, Final Project Assessment (2012)
4	251.6	251.6	-	SR 87/Aero Drive intersection - Conduct a traffic warrant study. Intersection needs to be reconstructed to fix sight distance issues if traffic signal not warranted		√			N/A	N	Payson Transportation Study (2011)
5	251.9	253	1.1	SR 87- Main Street to SR 260 - Incorporate recommendations from Road Safety Assessment (RSA) and Traffic Operational Analysis Study (TOAS).		√			N/A	N	Payson Transportation Study (2011)
6	251.5	251.5	-	SR 87/ Phoenix Street intersection - Conduct intersection safety study and implement recommendations.		√			N/A	N	Payson Transportation Study (2011)
7	253	253	-	SR 87/SR 260 intersection - Incorporate recommendations from RSA and TOAS.		√			N/A	N	Payson Transportation Study (2011) RSA: SR 87 MP 252.3 to 252.9, SR 260 MP 251.9 to 252.3 (2010)
8	251.9 252	251.9 252	-	SR 87/Main Street, SR 87/ Frontier Street and two other locations - Conduct one traffic safety study that covers all intersections.		√			N/A	N	Payson Transportation Study (2011)
9	252	253	1	SR 87 – North of Aero Drive to north of Frontier Street - Conduct a drainage study.		√			N/A	N	Payson Transportation Study (2011)
10	N/A	N/A	-	Construct alternative route to SR 87/SR 260 Corridor in Payson			√		N/A	N	BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010) Payson Transportation Study (2011)

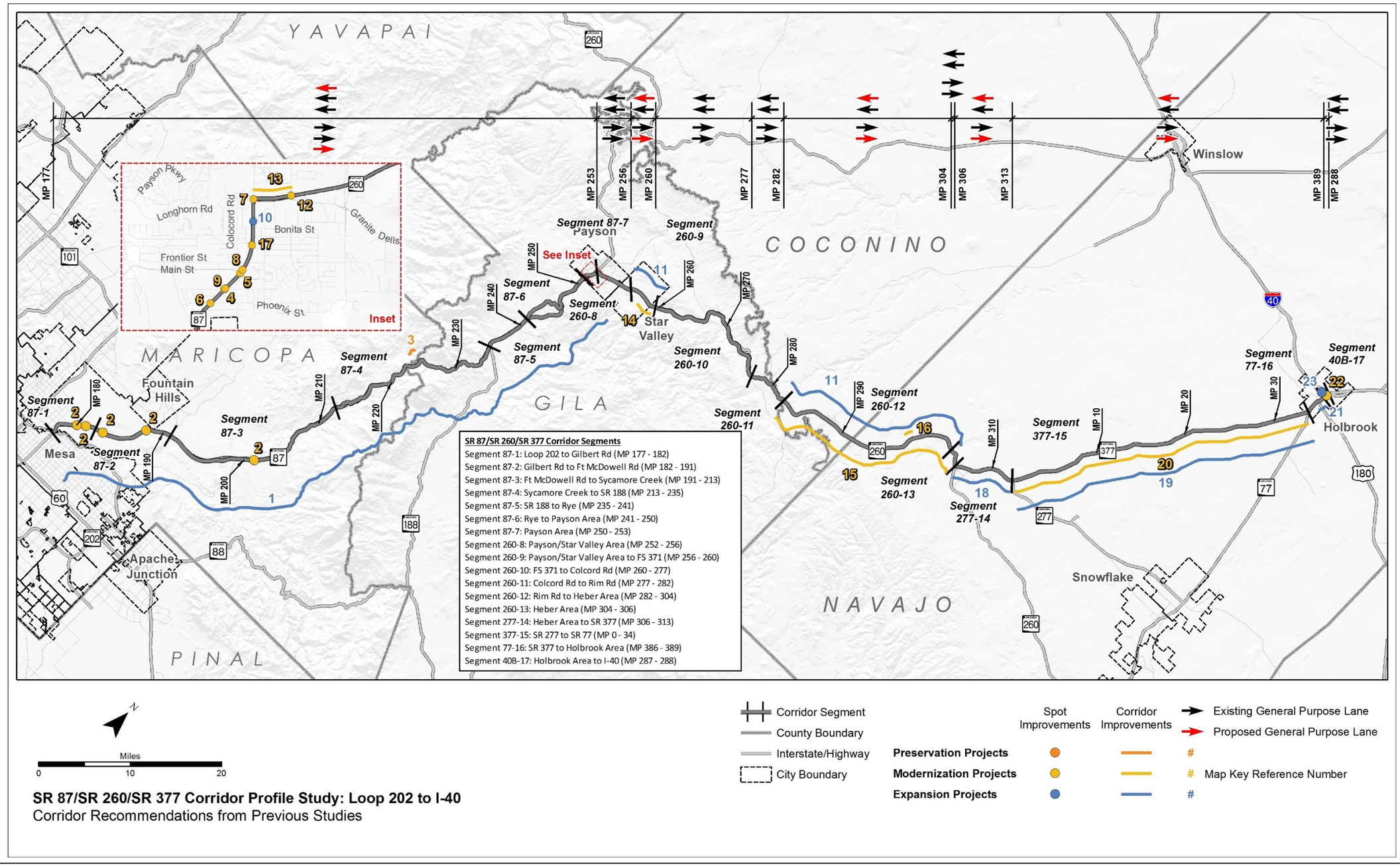
Table 3: Corridor Recommendations from Previous Studies (continued)

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization [M], Expansion [E])			Status of Recommendation			Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)?	
SR 260											
11	256 282	260 304	26	Widen/upgrade SR 260 to 4 lanes			√		N/A	N	BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010)
12	252.3	252.3	-	SR 260/Manzanita Drive intersection - Incorporate recommendations from RSA and TOAS		√			N/A	N	Payson Transportation Study (2011)
13	250	252.3	2.3	SR 260 - SR 87 to Manzanita Drive - Incorporate recommendations from RSA and TOAS		√			N/A	N	Payson Transportation Study (2011)
14	258	260	2	SR 260, Lion Springs Section, rural corridor reconstruction to 4-lane divided highway			√	FY2021 (Design)	21301/ Fxxxx01D	N	ADOT 2017-2021, Five-Year Facility Construction Program
15	282.5	305.9	23.4	Construct shoulder widening, Rim Rd to Gibson Rd Segment 2. The project also includes pipe and culvert extensions and relocation of roadside culverts, as well as adding guardrail at two locations.		√			N/A	N	SR 260, MP 282.5 to 305.9, Rim Road to Gibson Road Final PA (2014)
16	288	289	1	Construct climbing lane on SR 260 EB MP 288 to 289		√			N/A	N	ADOT Climbing and Passing Lane Prioritization Study (2015)
17	N/A	N/A	-	Provide a minor transit center in Payson		√			N/A	N	BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010)
SR 277											
18	306	313	7	Widen/upgrade SR 277 to 4 lanes			√		N/A	N	BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010)
SR 377											
19	0	34	34	Widen/upgrade SR 377 to 4 lanes			√		N/A	N	BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010)
20	0	34	34	SR 377: SR 277 to SR 77 various locations, reconstruct curves		√		FY2018	6710/ H893001C	N	ADOT 2017-2021, Five-Year Facility Construction Program SR 377 HES Evaluation, MP 0 - MP 34 (2005) SR 377: SR 277 Holbrook, Initial PA (2007)

Table 3: Corridor Recommendations from Previous Studies (continued)

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization [M], Expansion [E])			Status of Recommendation			Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)?	
SR 77											
21	386	389	3	Widen SR 77 Holbrook to Tucson			√		N/A	N	BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010)
I-40 Business											
22	N/A	N/A	-	Provide a major transit center in Holbrook		√			N/A	N	BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010)
23	N/A	N/A	-	Provide an alternative, grade-separated route from SR 77 to I-40			√		N/A	N	Navajo County Central Region Transportation Study (2010)

Figure 4: Corridor Recommendations from Previous Studies



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Corridor Recommendations from Previous Studies

2.0 CORRIDOR PERFORMANCE

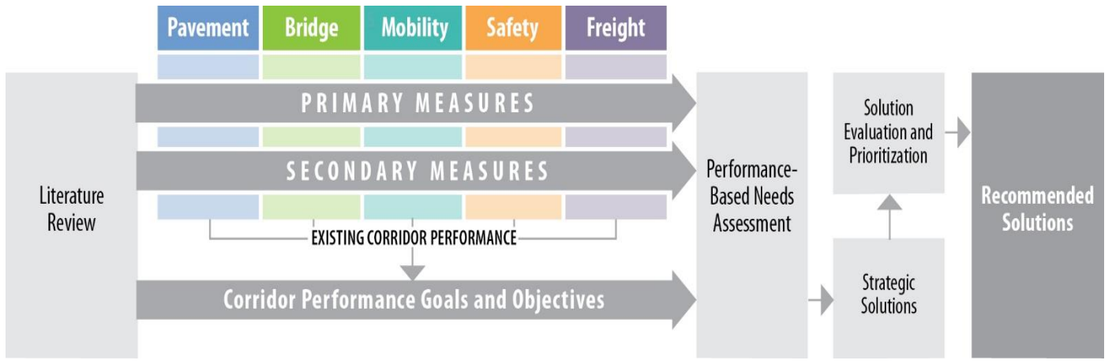
This chapter describes the evaluation of the existing performance of the SR 87/SR 260/SR 377 corridor. A series of performance measures is used to assess the corridor. The results of the performance evaluation are used to define corridor needs relative to the long-term goals and objectives for the corridor.

2.1 Corridor Performance Framework

This study uses a performance-based process to define baseline corridor performance, diagnose corridor needs, develop corridor solutions, and prioritize strategic corridor investments. In support of this objective, a framework for the performance-based process was developed through a collaborative process involving ADOT and the CPS consultant teams.

Figure 5 illustrates the performance framework, which includes a two-tiered system of performance measures (primary and secondary) to evaluate baseline performance. The primary measures in each of five performance areas are used to define the overall health of the corridor, while the secondary measures identify locations that warrant further diagnostic investigation to delineate needs. Needs are defined as the difference between baseline corridor performance and established performance objectives.

Figure 5: Corridor Profile Performance Framework



The following five performance areas guide the performance-based corridor analyses:

- Pavement
- Bridge
- Mobility
- Safety
- Freight

These performance areas reflect national performance goals stated in *Moving Ahead for Progress in the 21st Century* (MAP-21):

- Safety: To achieve a significant reduction in traffic fatalities and serious injuries on all public roads
- Infrastructure Condition: To maintain the highway infrastructure asset system in a state of good repair
- Congestion Reduction: To achieve a significant reduction in congestion on the National Highway System
- System Reliability: To improve the efficiency of the surface transportation system
- Freight Movement and Economic Vitality: To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development
- Environmental Sustainability: To enhance the performance of the transportation system while protecting and enhancing the natural environment
- Reduced Project Delivery Delays: To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion

The MAP-21 performance goals were considered in the development of ADOT's P2P process, which integrates transportation planning with capital improvement programming and project delivery. Because the P2P program requires the preparation of annual transportation system performance reports using the five performance areas adopted for the CPS, consistency is achieved in the performance measures used for various ADOT analysis processes.

The performance measures include five primary measures: Pavement Index, Bridge Index, Mobility Index, Safety Index, and Freight Index. Additionally, a set of secondary performance measures provides for a more detailed analysis of corridor performance.

Each of the primary and secondary performance measures is comprised of one or more quantifiable indicators. A three-level scale was developed to standardize the performance scale across the five performance areas, with numerical thresholds specific to each performance measure:

Good/Above Average Performance – Rating is above the identified desirable/average range

Fair/Average Performance – Rating is within the identified desirable/average range

Poor/Below Average Performance – Rating is below the identified desirable/average range

Table 4 provides the complete list of primary and secondary performance measures for each of the five performance areas.

Table 4: Corridor Performance Measures

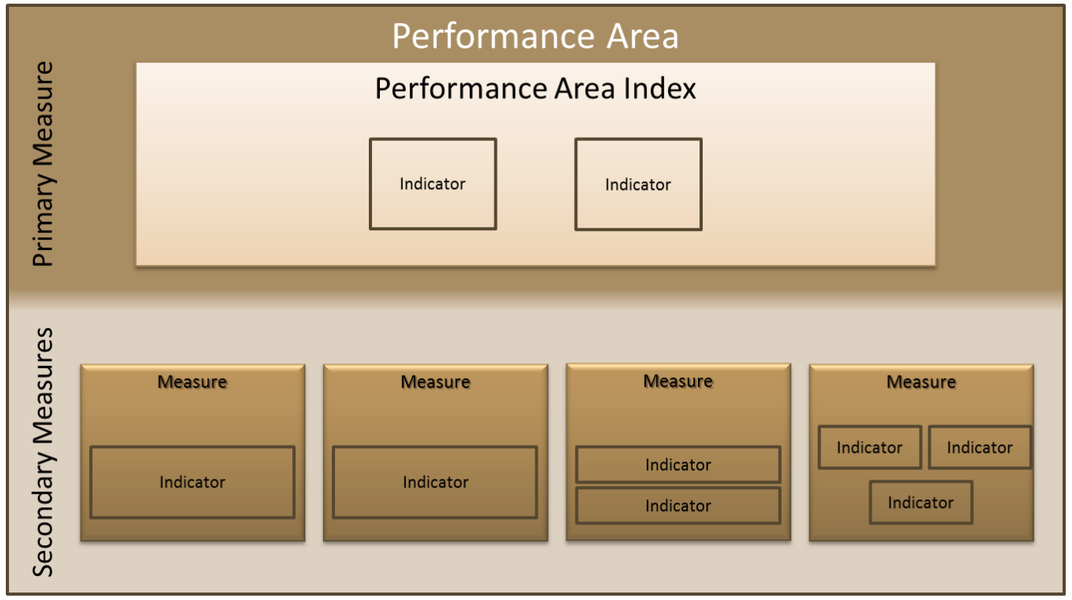
Performance Area	Primary Measure	Secondary Measures
Pavement	**Pavement Index** Based on a combination of International Roughness Index and cracking	• Directional Pavement Serviceability • Pavement Failure • Pavement Hot Spots
Bridge	**Bridge Index** Based on lowest of deck, substructure, superstructure and structural evaluation rating	• Bridge Sufficiency • Functionally Obsolete Bridges • Bridge Rating • Bridge Hot Spots
Mobility	**Mobility Index** Based on combination of existing and future daily volume-to-capacity ratios	• Future Congestion • Peak Congestion • Travel Time Reliability • Multimodal Opportunities
Safety	**Safety Index** Based on frequency of fatal and incapacitating injury crashes	• Directional Safety Index • Strategic Highway Safety Plan Emphasis Areas • Crash Unit Types • Safety Hot Spots
Freight	**Freight Index** Based on bi-directional truck planning time index	• Recurring Delay • Non-Recurring Delay • Closure Duration • Bridge Vertical Clearance • Bridge Vertical Clearance Hot Spots

The general template for each performance area is illustrated in **Figure 6**.

The guidelines for performance measure development are:

- Indicators and performance measures for each performance area should be developed for relatively homogeneous corridor segments
- Performance measures for each performance area should be tiered, consisting of primary measure(s) and secondary measure(s)
- Primary and secondary measures should assist in identifying those corridor segments that warrant in-depth diagnostic analyses to identify performance-based needs and a range of corrective actions known as solution sets
- One or more primary performance measures should be used to develop a Performance Index to communicate the overall health of a corridor and its segments for each performance area; the Performance Index should be a single numerical index that is quantifiable, repeatable, scalable, and capable of being mapped; primary performance measures should be transformed into a Performance Index using mathematical or statistical methods to combine one or more data fields from an available ADOT database
- One or more secondary performance measure indicators should be used to provide additional details to define corridor locations that warrant further diagnostic analysis; secondary performance measures may include the individual indicators used to calculate the Performance Index and/or "hot spot" features

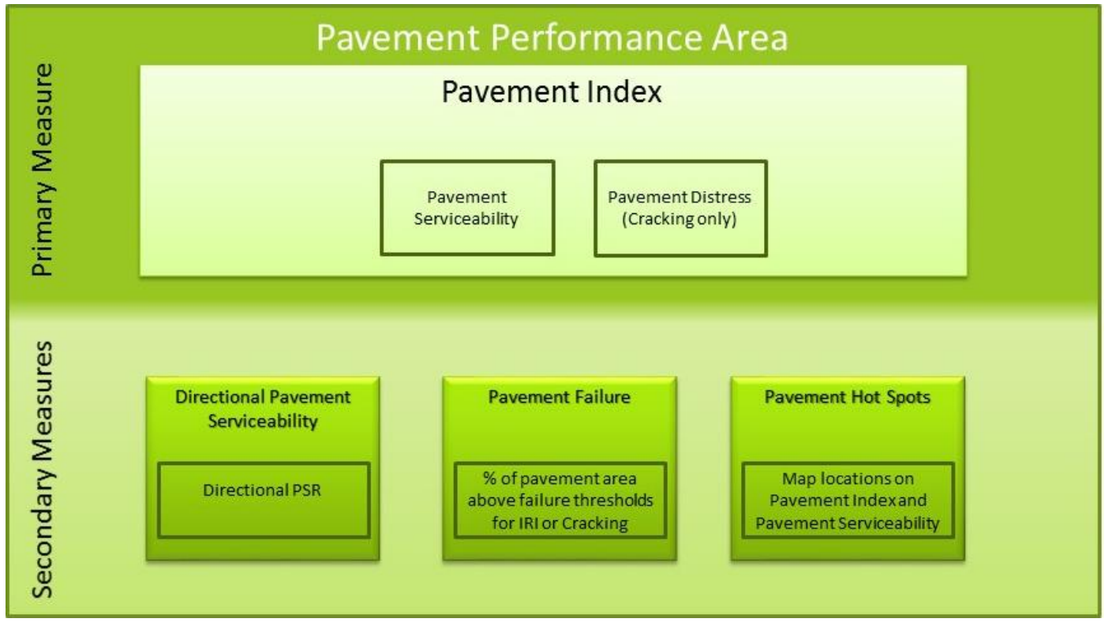
Figure 6: Performance Area Template



2.2 Pavement Performance Area

The Pavement performance area consists of a primary measure (Pavement Index) and three secondary measures, as shown in **Figure 7**. These measures assess the condition of the existing pavement along the SR 87/SR 260/SR 377 corridor. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

Figure 7: Pavement Performance Measures



Primary Pavement Index

The Pavement Index is calculated using two pavement condition ratings: the Pavement Serviceability Rating (PSR) and the Pavement Distress Index (PDI).

The PSR is extracted from the International Roughness Index (IRI), a measurement of pavement roughness based on field-measured longitudinal roadway profiles. The PDI is extracted from the Cracking Rating (CR), a field-measured sample from each mile of highway.

Both the PSR and PDI use a 0 to 5 scale with 0 representing the lowest performance and 5 representing the highest. The Pavement Index for each segment is a weighted average of the directional ratings based on the number of travel lanes. Therefore, the condition of a section with more travel lanes will have a greater influence on the resulting segment Pavement Index than the condition of a section with fewer travel lanes.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Pavement performance area, the relevant operating environments are designated as interstate and non-interstate segments. For the SR 87/SR 260/SR 377 corridor, the following operating environment was identified:

- Non-interstate: all segments

Secondary Pavement Measures

Three secondary measures provide an in-depth evaluation of the different characteristics of pavement performance.

Directional Pavement Serviceability

- Weighted average (based on number of lanes) of the PSR for the pavement in each direction of travel

Pavement Failure

- Percentage of pavement area rated above failure thresholds for IRI or Cracking

Pavement Hot Spots

- A Pavement “hot spot” exists where a given one-mile section of roadway rates as being in “poor” condition
- Highlights problem areas that may be under-represented in a segment average; this measure is recorded and mapped, but not included in the Pavement performance area rating calculations

Pavement Performance Results

The Pavement Index provides a high-level assessment of the pavement condition for the corridor and for each segment. The three secondary measures provide more detailed information to assess pavement performance.

Based on the results of this analysis, the following observations were made:

- The weighted average of the Pavement Index shows “good” overall performance for the SR 87/SR 260/SR 377 corridor
- According to the Pavement Index, nearly all of the pavement is in “good” condition with the exception of Segments 260-13, 277-14, and 77-16
- No pavement condition data was available for MP 224-226 in Segment 87-4
- Segment 40B-17, the short 1-mile section of I-40B, did not have sufficient data to calculate ratings
- Segments 260-13, 277-14, and 77-16 have “poor” % Pavement Area Failure ratings
- Pavement hot spots along the corridor include:
    - Segment 87-1 northbound (NB) MP 177-178
    - Segment 87-3 southbound (SB) MP 195-199, 200-201
    - Segment 87-4 NB/SB MP 224-226

- Segment 260-12 eastbound (EB) MP 288-289
- Segment 260-13 EB MP 304-305
- Segment 277-14 EB MP 307-310, 311-313
- Segment 77-16 NB MP 388-389

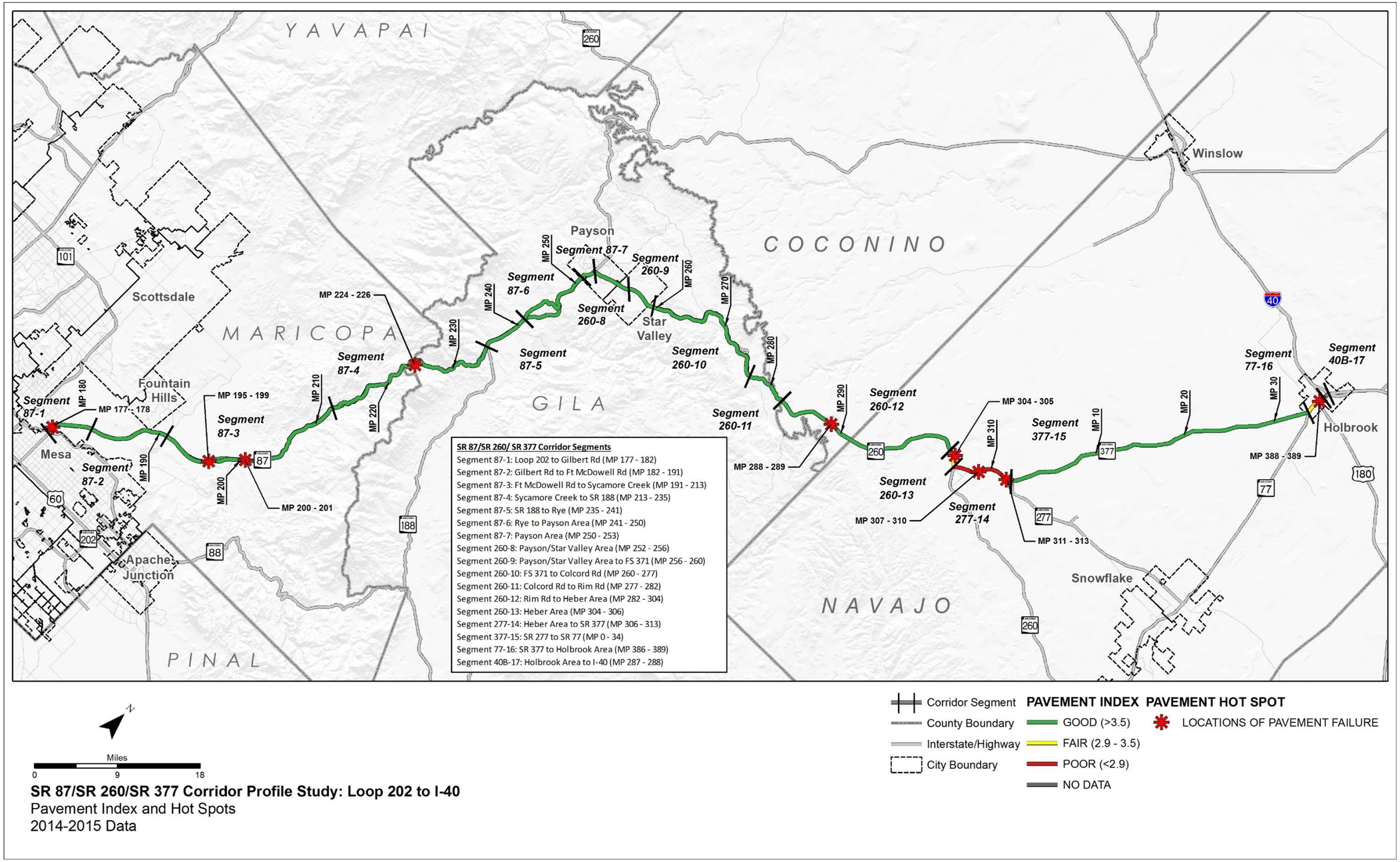
Table 5 summarizes the Pavement performance results for the SR 87/SR 260/SR 377 corridor. **Figure 8** illustrates the primary Pavement Index performance and locations of Pavement hot spots along the SR 87/SR 260/SR 377 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 5: Pavement Performance

Segment #	Segment Length (miles)	Pavement Index	Directional PSR		% Area Failure
			NB/EB	SB/WB	
87-1	5	4.19	4.03	4.11	10.0%
87-2	9	4.25	4.01	4.14	0.0%
87-3	22	3.80	3.80	3.88	11.4%
87-4	22	4.05	3.84	3.93	0.0%
87-5	5	4.55	4.35	4.36	0.0%
87-6	10	4.15	4.10	3.96	0.0%
87-7	2	3.54	3.36	3.48	0.0%
260-8	4	4.31	4.24		0.0%
260-9	3	4.27	4.12		0.0%
260-10	17	4.03	3.79	3.81	0.0%
260-11	5	4.13	3.98		0.0%
260-12	22	3.78	3.52		4.5%
260-13	2	3.11	2.87		50.0%
277-14	7	2.05	3.03		71.4%
377-15	34	4.12	4.03		0.0%
77-16	2	3.25	3.10		40.0%
40B-17	1	No Data			
Weighted Corridor Average		3.94	3.83	3.86	6.3%

SCALES		
Performance Level	**Non-Interstate**	
Good	> 3.50	< 5%
Fair	2.90 - 3.50	5% - 20%
Poor	< 2.90	> 20%

Figure 8: Pavement Performance

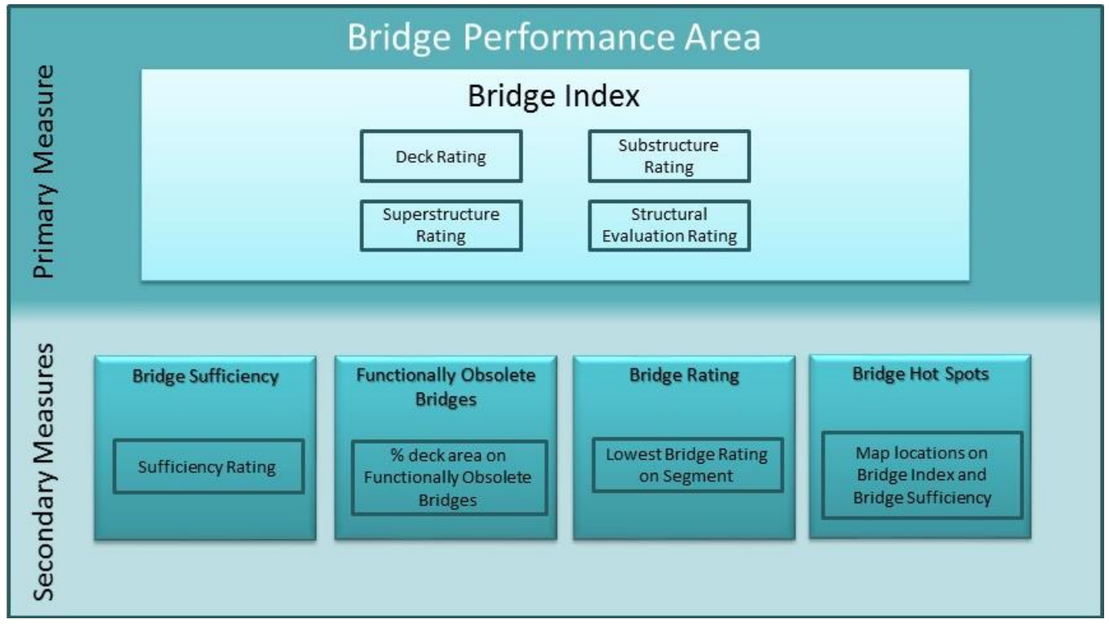


SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Pavement Index and Hot Spots
2014-2015 Data

2.3 Bridge Performance Area

The Bridge performance area consists of a primary measure (Bridge Index) and four secondary measures, as shown in **Figure 9**. These measures assess the condition of the existing bridges along the SR 87/SR 260/SR 377 corridor. Only bridges that carry mainline traffic or bridges that cross the mainline are included in the calculation. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

Figure 9: Bridge Performance Measures



Primary Bridge Index

The Bridge Index is calculated based on the use of four different bridge condition ratings from the ADOT Bridge Database, also known as the Arizona Bridge Information and Storage System (ABISS). The four ratings are the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating. These ratings are based on inspection reports and establish the structural adequacy of each bridge. The performance of each individual bridge is established by using the lowest of these four ratings. The use of these ratings, and the use of the lowest rating, is consistent with the approach used by the ADOT Bridge Group to assess the need for bridge rehabilitation. The Bridge Index is calculated as a weighted average for each segment based on deck area.

Secondary Bridge Measures

Four secondary measures provide an in-depth evaluation of the characteristics of each bridge:

Bridge Sufficiency

- Multipart rating includes structural adequacy and safety factors as well as functional aspects such as traffic volume and length of detour
- Rates the structural and functional sufficiency of each bridge on a 100-point scale

Functionally Obsolete Bridges

- Percentage of total deck area in a segment that is on functionally obsolete bridges
- Identifies bridges that no longer meet standards for current traffic volumes, lane width, shoulder width, or bridge rails
- A bridge that is functionally obsolete may still be structurally sound

Bridge Rating

- The lowest rating of the four bridge condition ratings (substructure, superstructure, deck, and structural evaluation) on each segment
- Identifies lowest performing evaluation factor on each bridge

Bridge Hot Spots

- A Bridge “hot spot” is identified where a given bridge has a bridge rating of 4 or lower or multiple ratings of 5 between the deck, superstructure, and substructure ratings
- Identifies particularly low-performing bridges or those that may decline to low performance in the immediate future

Bridge Performance Results

The Bridge Index provides a high-level assessment of the structural condition of bridges for the corridor and for each segment. The four secondary measures provide more detailed information to assess bridge performance.

Based on the results of this analysis, the following observations were made:

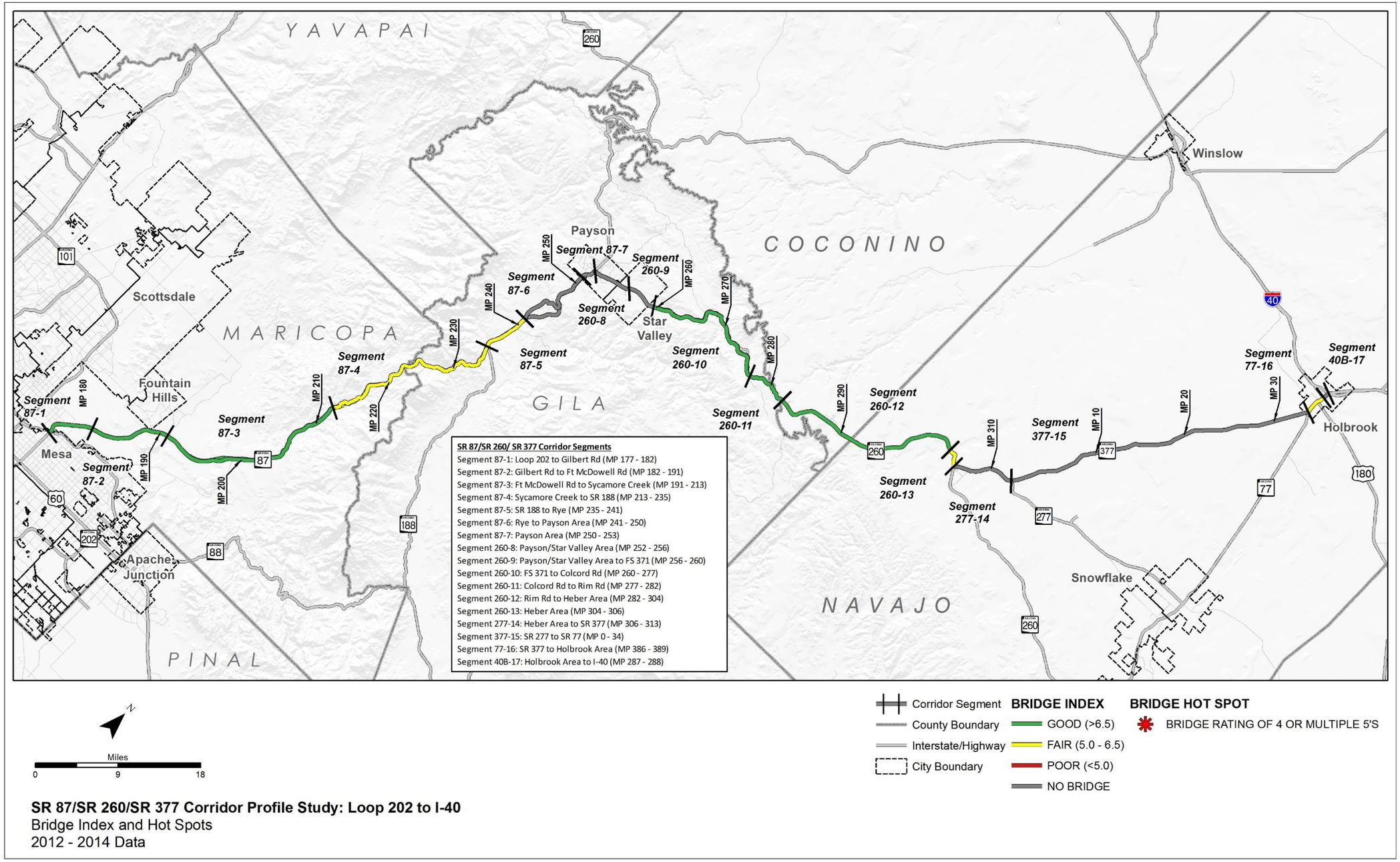
- The weighted average of the Bridge Index shows “good” overall performance for the SR 87/SR 260/SR 377 corridor
- All segments that contain bridges have a “fair” or “good” Bridge Index rating
- All segments that contain bridges have a “good” Sufficiency Rating except Segments 260-11 and 77-16, which have a “fair” Sufficiency Rating
- There is one functionally obsolete bridge in Segment 77-16 (Little Colorado River Bridge, #2030)
- All segments that contain bridges have a “fair” or “good” Lowest Bridge Rating
- There are no bridge hot spots along the corridor

Table 6 summarizes the Bridge performance results for the SR 87/SR 260/SR 377 corridor. **Figure 10** illustrates the primary Bridge Index performance and locations of Bridge hot spots along the SR 87/SR 260/SR 77 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 6: Bridge Performance

Segment #	Segment Length (miles)	# of Bridges	Bridge Index	Sufficiency Rating	% of Deck Area on Functionally Obsolete Bridges	Lowest Bridge Rating
87-1	5	1	7.00	85.00	0.0%	7
87-2	9	2	7.00	96.50	0.0%	7
87-3	22	7	6.95	96.20	0.0%	6
87-4	22	10	6.31	89.18	0.0%	6
87-5	6	4	6.31	99.60	0.0%	6
87-6	9	0	No Bridges			
87-7	3	0	No Bridges			
260-8	4	0	No Bridges			
260-9	4	0	No Bridges			
260-10	17	33	6.81	99.52	0.0%	6
260-11	5	3	6.73	79.13	0.0%	6
260-12	22	1	7.00	98.40	0.0%	7
260-13	2	1	6.00	93.70	0.0%	6
277-14	7	0	No Bridges			
377-15	34	0	No Bridges			
77-16	3	1	6.00	59.00	100%	6
40B-17	1	0	No Bridges			
Weighted Corridor Average			6.70	95.46	1.6	6.06
SCALES						
Performance Level			**All**			
Good			> 6.5	> 80	< 12%	> 6
Fair			5.0 - 6.5	50 - 80	12% - 40%	5 - 6
Poor			< 5.0	< 50	> 40 %	< 5

Figure 10: Bridge Performance

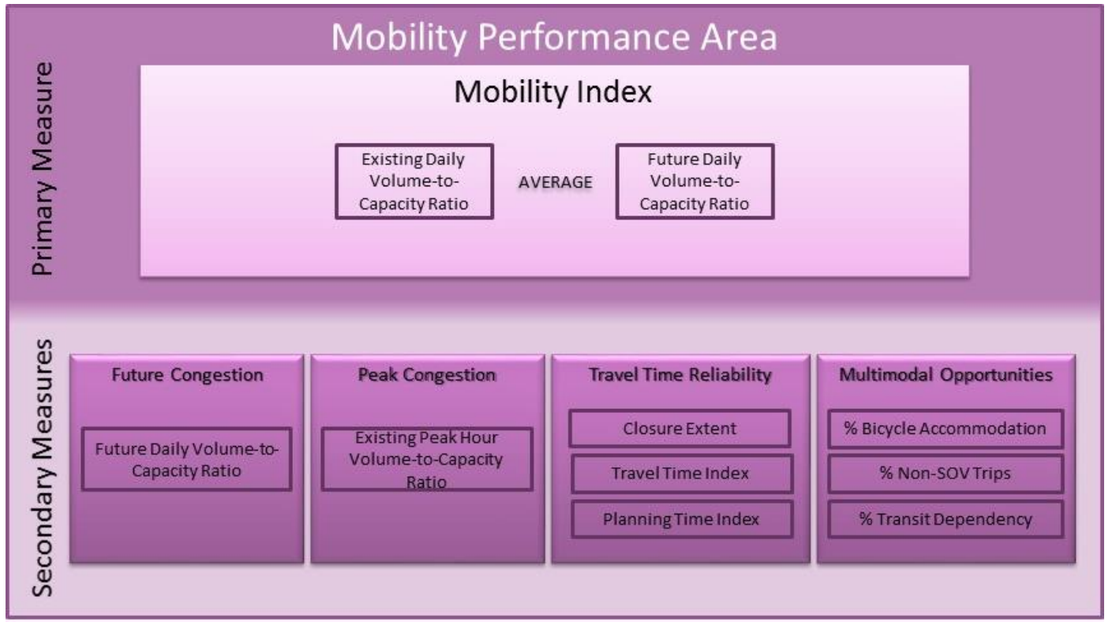


SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Bridge Index and Hot Spots
2012 - 2014 Data

2.4 Mobility Performance Area

The Mobility performance area consists of a primary measure (Mobility Index) and four secondary measures, as shown in **Figure 11**. These measures assess the condition of existing mobility along the SR 87/SR 260/SR 377 corridor. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

Figure 11: Mobility Performance Measures



Primary Mobility Index

The Mobility Index is an average of the existing (2014) daily volume-to-capacity (V/C) ratio and the future (2035 AZTDM) daily V/C ratio for each segment of the corridor. The V/C ratio is an indicator of the level of congestion. This measure compares the average annual daily traffic (AADT) volume to the capacity of the corridor segment as defined by the service volume for level of service (LOS) E. By using the average of the existing and future year daily volumes, this index measures the level of daily congestion projected to occur in approximately ten years (2025) if no capacity improvements are made to the corridor.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Mobility performance area, the relevant operating environments are urban vs. rural setting and interrupted flow (e.g., signalized at-grade intersections are present) vs. interrupted flow (e.g., controlled access grade-separated conditions such as freeway or interstate highway). For the SR 87/SR 260/SR 377 corridor, the following operating environments were identified:

- Urban Interrupted Flow: Segments 87-1, 87-2, 87-7, 260-8, 77-16, and 40B-17
- Rural Uninterrupted Flow: Segments 87-3, 87-4, 87-5, 87-6, 260-9, 260-10, 260-11, 260-12, 260-13, 277-14, and 377-15

Secondary Mobility Measures

Four secondary measures provide an in-depth evaluation of operational characteristics of the corridor:

Future Congestion – Future Daily V/C

- The future (2035 AZTDM) daily V/C ratio; this measure is the same value used in the calculation of the Mobility Index
- Provides a measure of future congestion if no capacity improvements are made to the corridor

Peak Congestion – Existing Peak Hour V/C

- The peak hour V/C ratio for each direction of travel
- Provides a measure of existing peak hour congestion during typical weekdays

Travel Time Reliability– Three separate travel time reliability indicators together provide a comprehensive picture of how much time may be required to travel within the corridor:

- Closure Extent
  - The average number of instances a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel; a weighted average was applied to each closure that takes into account the distance over which the closure spans
  - Closures related to crashes, weather, or other incidents are a significant contributor to non-recurring delays; construction-related closures were excluded from the analysis
- Directional Travel Time Index (TTI):
  - The ratio of the average peak period travel time to the free-flow travel time (based on the posted speed limit) in a given direction
  - The TTI recognizes the delay potential from recurring congestion during peak periods; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics
- Directional Planning Time Index (PTI):
  - The ratio of the 95th percentile travel time to the free-flow travel time (based on the posted speed limit) in a given direction

- The PTI recognizes the delay potential from non-recurring delays such as traffic crashes, weather, or other incidents; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics
- The PTI indicates the amount of time in addition to the typical travel time that should be allocated to make an on-time trip 95% of the time in a given direction

Multimodal Opportunities – Three multimodal opportunity indicators reflect the characteristics of the corridor that promote alternate modes to the single occupancy vehicle (SOV) for trips along the corridor:

- % Bicycle Accommodation:
  - Percentage of the segment that accommodates bicycle travel; bicycle accommodation on the roadway or on shoulders varies depending on traffic volumes, speed limits, and surface type
  - Encouraging bicycle travel has the potential to reduce automobile travel, especially on non-interstate highways
- % Non-SOV Trips:
  - The percentage of trips (less than 50 miles in length) by non-SOVs
  - The percentage of non-SOV trips in a corridor gives an indication of travel patterns along a section of roadway that could benefit from additional multimodal options
- % Transit Dependency:
  - The percentage of households that have zero or one automobile and households where the total income level is below the federally defined poverty level
  - Used to track the level of need among those who are considered transit dependent and more likely to utilize transit if it is available

Mobility Performance Results

The Mobility Index provides a high-level assessment of mobility conditions for the corridor and for each segment. The four secondary measures provide more detailed information to assess mobility performance.

Based on the results of this analysis, the following observations were made:

- The weighted average of the Mobility Index shows “good” overall performance for the SR 87/SR 260/SR 377 corridor, with Segments 87-2, 87-7, and 77-16 indicating “fair” performance and Segment 260-9 indicating “poor” performance
- During the existing peak hour, traffic operations are “good” for all segments except Segment 260-9
- Segments 87-2, 87-7, 260-9, and 77-16 are anticipated to have “poor” performance in the future, according to the Future Daily V/C performance indicator
- Segments 87-3 and 87-4 have “poor” performance in the Closure Extent performance indicator for NB travel; Segments 260-11 and 260-12 have “poor” performance in the Closure Extent performance indicator for westbound (WB) travel
- TTI and PTI data was not available for Segments 277-14 and 377-15
- The TTI performance indicator shows that all segments on the SR 87/SR 260/SR 377 corridor performance at “fair” or “good” performance level
- The PTI performance indicator shows many of the SR 87/SR 260/SR 377 segments, both NB/EB and SB/WB, have “fair” or “poor” performance in terms of reliability
- More than half of SR 87/SR 260/SR 377 segments show “poor” or “fair” performance for non-SOV trips, indicating single occupant trips are more common
- A majority of the corridor shows “poor” performance in % Bicycle Accommodation, indicating most of the corridor – particularly those segments not pertaining to SR 87 – has narrow shoulders

Table 7 summarizes the Mobility performance results for the SR 87/SR 260/SR 377 corridor. **Figure 12** illustrates the primary Mobility Index performance along the SR 87/SR 260/SR 377 corridor. Maps for each secondary measure can be found in **Appendix A**.

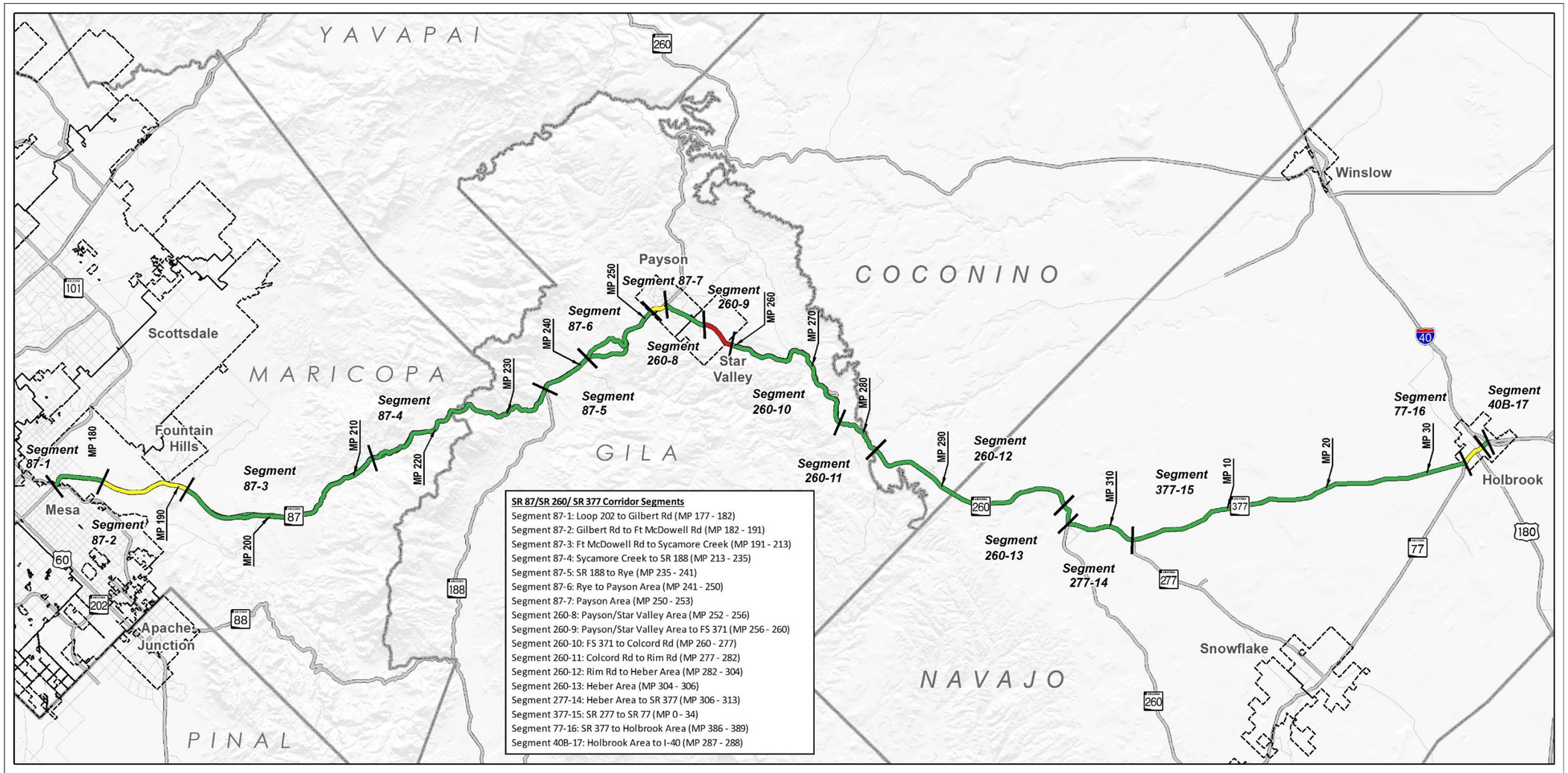
Table 7: Mobility Performance

Segment #	Segment Length (miles)	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/milepost/year/mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips
				NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB		
87-1[1]*	5	0.65	0.86	0.34	0.34	0.37	0.32	1.22	1.06	4.01	3.03	45%	13.6%
87-2[1]*	9	0.73	1.01	0.45	0.45	0.46	0.04	1.15	1.23	2.36	3.86	93%	14.4%
87-3[2]^	22	0.21	0.29	0.14	0.13	0.87	0.11	1.05	1.04	1.54	1.48	99%	16.7%
87-4[2]^	22	0.23	0.27	0.20	0.21	1.47	0.15	1.17	1.05	2.05	1.47	86%	5.2%
87-5[2]^	5	0.15	0.14	0.15	0.15	0.23	0.07	1.01	1.08	1.42	1.51	92%	12.9%
87-6[2]^	10	0.21	0.21	0.19	0.19	0.18	0.27	1.31	1.15	2.38	1.94	79%	12.4%
87-7[1]*	2	0.75	0.94	0.57	0.50	0.07	0.20	1.18	1.86	4.43	6.48	56%	18.4%
260-8[1]*	4	0.54	0.68	0.47	0.51	0.05	0.00	1.46	1.10	7.15	4.97	16%	18.5%
260-9[2]^	3	0.94	1.15	1.29	1.33	0.30	0.55	1.12	1.00	1.61	1.16	2%	15.1%
260-10[2]^	17	0.08	0.08	0.13	0.11	0.49	0.48	1.13	1.06	1.64	1.40	93%	16.2%
260-11[2]^	5	0.12	0.14	0.14	0.13	0.40	0.88	1.23	1.00	2.16	1.14	49%	12.5%
260-12[2]^	22	0.36	0.39	0.34	0.34	0.43	0.85	1.00	1.05	1.18	1.36	2%	10.8%
260-13[1]^	2	0.14	0.15	0.14	0.14	0.00	0.40	1.02	1.21	1.63	2.98	15%	6.7%
277-14[2]^	7	0.09	0.10	0.07	0.06	0.11	0.00	No Data				0%	17.5%
377-15[2]^	34	0.09	0.10	0.13	0.13	0.04	0.05	No Data				0%	18.2%
77-16[1]*	2	0.85	1.09	0.60	0.65	0.00	0.00	1.08	1.49	3.84	6.79	1%	18.7%
40B-17[1]*	1	0.45	0.57	0.32	0.32	No Data		1.80	1.31	12.93	10.56	27%	20.7%
Weighted Corridor Average		0.26	0.32	0.24	0.23	0.49	0.27	1.13	1.09	2.15	2.03	49%	14.0%

SCALES					
Performance Level	**Urban or Rural**	**All**	**Uninterrupted or Interrupted**		**All**
Good	< 0.71[1] < 0.56[2]	< 0.22	< 1.15^ < 1.30*	< 1.30^ < 3.00*	> 90%	> 17%
Fair	0.71 - 0.89[1] 0.56 - 0.76[2]	0.22 – 0.62	1.15 - 1.33^ 1.30 - 2.00*	1.30 - 1.50^ 3.00 - 6.00*	60% - 90%	11% - 17%
Poor	> 0.89[1] > 0.76[2]	> 0.62	> 1.33^ > 2.00*	> 1.50^ > 6.00*	< 60%	< 11%

[1]Urban Operating Environment
[2]Rural Operating Environment
^Uninterrupted Flow Facility
*Interrupted Flow Facility

Figure 12: Mobility Performance

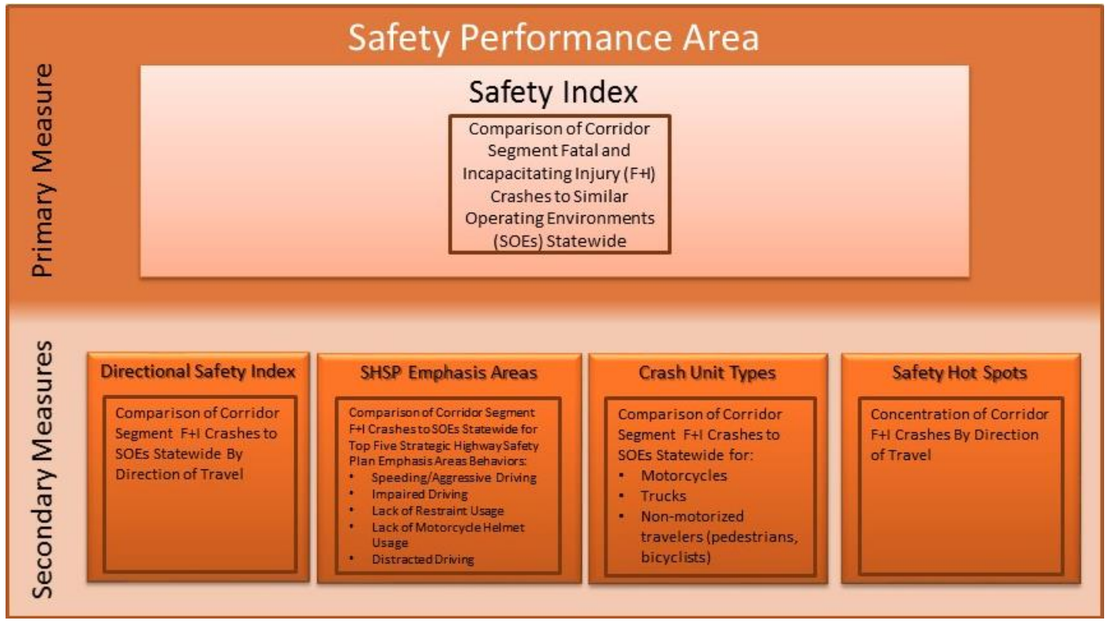


SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Mobility Index
2014 and 2035 Data

2.5 Safety Performance Area

The Safety performance area consists of a primary measure (Safety Index) and four secondary measures, as illustrated in **Figure 13**. All measures relate to crashes that result in fatal and incapacitating injuries, as these types of crashes are the emphasis of the ADOT Strategic Highway Safety Plan (SHSP), FHWA, and MAP-21. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

Figure 13: Safety Performance Measures



Primary Safety Index

The Safety Index is based on the bi-directional frequency and rate of fatal and incapacitating injury crashes, the relative cost of those types of crashes, and crash occurrences on similar roadways in Arizona. According to ADOT's 2010 Highway Safety Improvement Program Manual, fatal crashes have an estimated cost that is 14.5 times the estimated cost of incapacitating injury crashes ($5.8 million compared to $400,000).

Each corridor segment is rated on a scale by comparing the segment score with the average statewide score for similar operating environments. Because crash frequencies and rates vary depending on the operating environment of a particular roadway, statewide values were developed for similar operating environments defined by functional classification, urban vs. rural setting, number of travel lanes, and traffic volumes. For the SR 87/SR 260/SR 377 corridor, the following operating environments were identified:

- 2 or 3 or 4 Lane Divided Highway: Segments 87-1 to 87-6 and 260-10
- 4 or 5 Lane Undivided Highway: Segments 87-7, 260-8, 260-13, and 40B-17
- 2 or 3 lane Undivided Highway: Segments 260-9, 260-11, 260-12, 277-14, and 77-16

Secondary Safety Measures

Four secondary measures provide an in-depth evaluation of the different characteristics of safety performance:

Directional Safety Index

- This measure is based on the directional frequency and rate of fatal and incapacitating injury crashes

SHSP Emphasis Areas

ADOT's 2014 SHSP identified several emphasis areas for reducing fatal and incapacitating injury crashes. This measure compared rates of crashes in the top five SHSP emphasis areas to other corridors with a similar operating environment. The top five SHSP emphasis areas related to the following driver behaviors:

- Speeding and aggressive driving
- Impaired driving
- Lack of restraint usage
- Lack of motorcycle helmet usage
- Distracted driving

Crash Unit Types

- The percentage of total fatal and incapacitating injury crashes that involves crash unit types of motorcycles, trucks, or non-motorized travelers is compared to the statewide average on roads with similar operating environments

Safety Hot Spots

- The hot spot analysis identifies abnormally high concentrations of fatal and incapacitating injury crashes along the study corridor by direction of travel

For the Safety Index and the secondary safety measures, any segment that has too small of a sample size to generate statistically reliable performance ratings for a particular performance measure is considered to have "insufficient data" and is excluded from the safety performance evaluation for that particular performance measure.

Safety Performance Results

The Safety Index provides a high-level assessment of safety performance for the corridor and for each segment. The four secondary measures provide more detailed information to assess safety performance.

Based on the results of this analysis, the following observations were made:

- The crash unit type performance measures for crashes involving trucks and non-motorized travelers had insufficient data to generate reliable performance ratings for the SR 87/SR 260/SR 377 corridor
- Several segments had insufficient data to generate reliable performance ratings for crashes involving motorcycles or behaviors associated with the SHSP Top 5 Emphasis Areas
- A total of 129 fatal and incapacitating injury crashes occurred along the SR 87/SR 260/SR 377 corridor in 2010 - 2014; of these crashes, 48 were fatal and 81 involved incapacitating injuries
- The weighted average of the Safety Index shows “below average” performance for the SR 87/SR 260/SR 377 corridor compared to other segments statewide that have similar operating environments, meaning the corridor generally does not perform well as it relates to safety
- The Safety Index value for Segments 87-1, 87-4, 87-6, 260-12, and 377-15 is “below average”, meaning these segments have more crashes than is typical statewide
- The Directional Safety Index value for many segments, usually in only one of the directions for the corridor, is “below average”
- The percentage of crashes related to the SHSP Top 5 Emphasis Areas is higher in Segments 87-6 and 377-15 than the statewide average for similar operating environments
- Safety hot spots include:
    - NB, MP 213-215
    - SB, MP 245-248
    - NB, MP 252-253

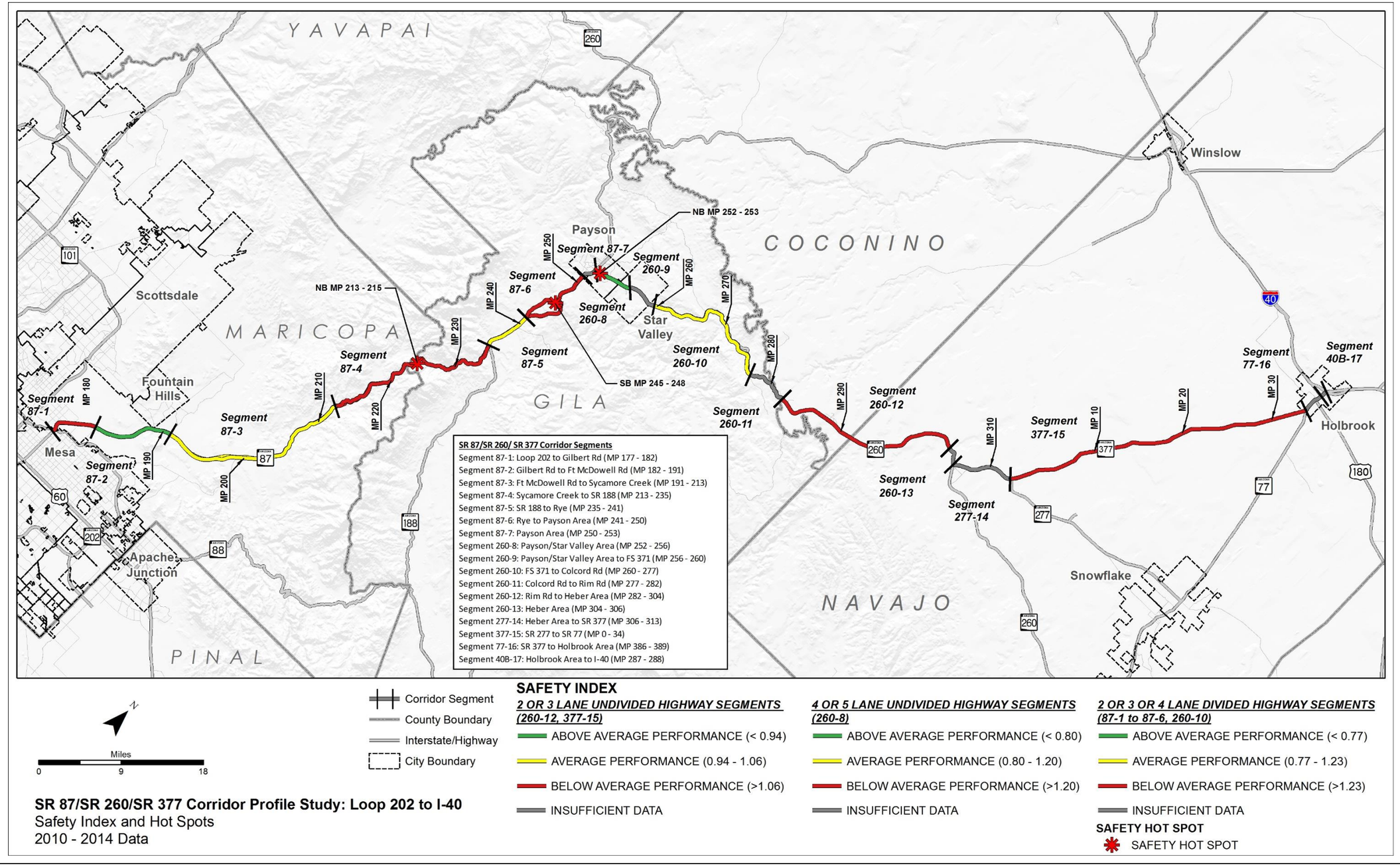
Table 8 summarizes the Safety performance results for the SR 87/SR 260/SR 377 corridor. **Figure 14** illustrates the primary Safety Index performance and locations of Safety hot spots along the SR 87/SR 260/SR 377 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 8: Safety Performance

Segment #	Segment Length (miles)	Total Fatal & Incapacitating Injury Crashes (F/I)	Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	% of Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers
				NB/EB	SB/WB				
87-1[a]	5	6/1	3.01	4.05	1.98	29%	Insufficient Data	Insufficient Data	Insufficient Data
87-2[a]	9	2/2	0.62	1.21	0.04	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
87-3[a]	22	7/11	1.19	0.48	1.90	44%	Insufficient Data	39%	Insufficient Data
87-4[a]	22	9/21	1.62	1.48	1.76	30%	Insufficient Data	50%	Insufficient Data
87-5[a]	5	2/1	1.22	0.08	2.36	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
87-6[a]	10	6/8	2.11	0.09	4.13	71%	Insufficient Data	14%	Insufficient Data
87-7[b]	2	1/2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
260-8[b]	4	0/7	0.28	0.56	0.00	43%	Insufficient Data	Insufficient Data	Insufficient Data
260-9[c]	3	1/2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
260-10[a]	17	3/5	0.93	0.62	1.24	50%	Insufficient Data	13%	Insufficient Data
260-11[c]	5	0/4	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
260-12[c]	22	5/8	1.43	2.25	0.62	46%	Insufficient Data	15%	Insufficient Data
260-13[b]	2	0/1	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
277-14[c]	7	0/1	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
377-15[c]	34	4/7	1.18	1.21	1.16	82%	Insufficient Data	0%	Insufficient Data
77-16[c]	2	1/0	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
40B-17[b]	1	1/0	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
Weighted Corridor Average			1.32	1.20	1.45	54%	Insufficient Data	21%	Insufficient Data
SCALES									
Performance Level	**2 or 3 or 4 Lane Divided Highway**								
Above Average	< 0.77			< 44%		< 4%		< 16%	< 2%
Average	0.77 – 1.23			44% - 54%		4% - 7%		16% - 26%	2% - 4%
Below Average	> 1.23			> 54%		> 7%		> 26%	> 4%
Performance Level	**4 or 5 Lane Undivided Highway**								
Above Average	< 0.80			< 42%		< 6%		< 6%	< 5%
Average	0.80 – 1.20			42% - 51%		6% - 10%		6% - 9%	5% - 8%
Below Average	> 1.20			> 51%		> 10%		> 9%	> 8%
Performance Level	**2 or 3 Lane Undivided Highway**								
Above Average	< 0.94			< 51%		< 6%		< 19%	< 5%
Average	0.94 – 1.06			51% - 58%		6% - 10%		19% - 27%	5% - 8%
Below Average	> 1.06			> 58%		> 10%		> 27%	> 8%

[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway
Note: "Insufficient Data" indicates there was not enough data available to generate reliable performance ratings

Figure 14: Safety Performance



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Safety Index and Hot Spots
2010 - 2014 Data

2.6 Freight Performance Area

The Freight performance area consists of a single primary measure (Freight Index) and five secondary measures, as illustrated in **Figure 15**. All measures related to the reliability of truck travel as measured by observed truck travel time speed and delays to truck travel from freeway closures or physical restrictions to truck travel. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

Figure 15: Freight Performance Measures

Primary Freight Index

The Freight Index is a reliability performance measure based on the PTI for truck travel. The Truck Planning Time Index (TPTI) is the ratio of the 95th percentile truck travel time to the free-flow truck travel time. The TPTI reflects the extra buffer time needed for on-time delivery while accounting for non-recurring delay. Non-recurring delay refers to unexpected or abnormal delay due to closures or restrictions resulting from circumstances such as crashes, inclement weather, and construction activities.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Freight performance area, the relevant operating environments are interrupted flow (e.g., signalized at-grade intersections are present) and uninterrupted flow (e.g., controlled access grade-separated conditions such as a freeway or interstate highway).

For the SR 87/SR 260/SR 377 corridor, the following operating environments were identified:

- Interrupted Flow: Segments 87-1, 87-2, 87-7, 260-8, 77-16, and 40B-17
- Uninterrupted Flow: Segments 87-3, 87-4, 87-5, 87-6, 260-9, 260-10, 260-11, 260-12, 260-13, 277-14, and 377-15

Secondary Freight Measures

The Freight performance area includes five secondary measures that provide an in-depth evaluation of the different characteristics of freight performance:

Recurring Delay (Directional Truck Travel Time Index [TTTI])

- The ratio of the average peak period truck travel time to the free-flow truck travel time (based on the posted speed limit up to a maximum of 65 miles per hour) in a given direction
- The TTTI recognizes the delay potential from recurring congestion during peak periods; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics

Non-Recurring Delay (Directional TPTI)

- The ratio of the 95th percentile truck travel time to the free-flow truck travel time (based on the posted speed limit up to a maximum of 65 miles per hour) in a given direction
- The TPTI recognizes the delay potential from non-recurring delays such as traffic crashes, weather, or other incidents; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics
- The TPTI indicates the amount of time in addition to the typical travel time that should be allocated to make an on-time trip 95% of the time in a given direction

Closure Duration

- The average time (in minutes) a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel; a weighted average is applied to each closure that takes into account the distance over which the closure occurs

Bridge Vertical Clearance

- The minimum vertical clearance (in feet) over the travel lanes for underpass structures on each segment

Bridge Vertical Clearance Hot Spots

- A Bridge vertical clearance “hot spot” exists where the underpass vertical clearance over the mainline travel lanes is less than 16.25 feet and no exit/entrance ramps exist to allow vehicles to bypass the low clearance location
- If a location with a vertical clearance less than 16.25 feet can be avoided by using immediately adjacent exit/entrance ramps rather than the mainline, it is not considered a hot spot

Freight Performance Results

The Freight Index provides a high-level assessment of the freight mobility for the corridor and for each segment. The five secondary measures provide more detailed information to assess freight performance.

Based on the results of this analysis, the following observations were made:

- The weighted average of the Freight Index shows "poor" overall performance for the SR 87/SR 260/SR 377 corridor; each of the segments show either "poor" or "fair" performance
- A majority of the segments show either "poor" or "fair" performance for Directional TPTI measures, meaning the corridor has "poor" or "fair" travel time reliability in the NB/EB and SB/WB direction due to non-recurring congestion
- TTTI and TPTI data was not available for Segments 277-14 and 377-15
- A majority of the segments show either "poor" or "fair" performance in the Closure Duration performance indicator
- Segments 87-3 and 87-4 show abnormally high directional closure durations; a review of the data indicates these high closure durations were due to SR 87 being closed for several days due to a fire
- Closure Duration data was not available for Segment 40B-17
- No Bridge Vertical Clearance hot spots exist along the SR 87/SR 260/SR 377 corridor

Table 9 summarizes the Freight performance results for the SR 87/SR 260/SR 377 corridor. **Figure 16** illustrates the primary Freight Index performance and locations of Freight hot spots along the SR 87/SR 260/SR 377 corridor. Maps for each secondary measure can be found in **Appendix A.**

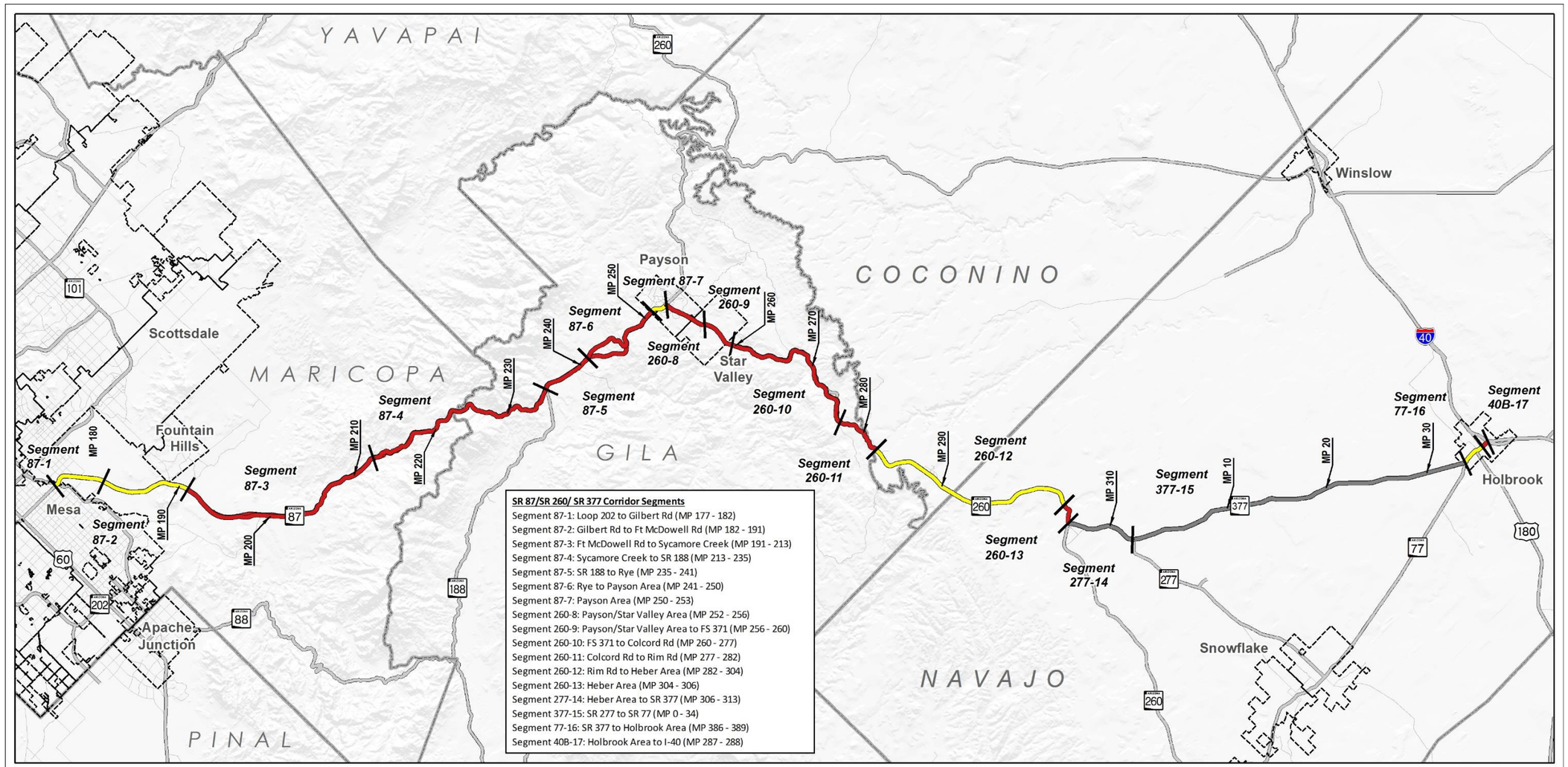
Table 9: Freight Performance

Segment #	Segment Length (miles)	Freight Index	Directional TTTI		Directional TPTI		Closure Duration (minutes/milepost /year/mile)		Bridge Vertical Clearance (feet)
			NB/ EB	SB/ WB	NB/ EB	SB/ WB	NB/ EB	SB/ WB	
87-1[1]*	5	0.28	1.29	1.10	3.88	3.38	129.19	61.92	No UP
87-2[1]*	9	0.29	1.19	1.32	2.72	4.06	119.84	147.44	No UP
87-3[2]^	22	0.53	1.11	1.23	1.38	2.38	2674.13	59.23	16.97
87-4[2]^	22	0.51	1.37	1.14	2.38	1.56	4359.89	34.01	18.75
87-5[2]^	5	0.56	1.12	1.21	1.45	2.13	49.20	21.67	No UP
87-6[2]^	10	0.44	1.55	1.22	2.52	2.01	37.16	287.98	No UP
87-7[1]*	2	0.28	1.20	1.91	3.29	3.88	21.33	693.60	No UP
260-8[1]*	4	0.15	1.66	1.17	9.64	4.11	11.45	0.00	No UP
260-9[2]^	3	0.47	1.20	1.00	3.09	1.21	71.85	726.90	No UP
260-10[2]^	17	0.58	1.23	1.12	1.82	1.61	157.49	797.71	No UP
260-11[2]^	5	0.54	1.45	1.00	2.53	1.18	144.40	922.04	No UP
260-12[2]^	22	0.69	1.00	1.10	1.19	1.69	117.01	901.62	No UP
260-13[1]^	2	0.36	1.09	1.35	2.75	2.82	0.00	739.30	No UP
277-14[2]^	7	No Data					20.03	0.00	No UP
377-15[2]^	34	No Data					10.14	9.29	No UP
77-16[1]*	2	0.22	1.12	1.54	3.52	5.65	0.00	0.00	No UP
40B-17[1]*	1	0.05	2.15	1.51	29.93	8.45	No Data		No UP
Weighted Corridor Average		0.50	1.24	1.18	2.46	2.25	957.0	289.9	17.87

SCALES					
Performance Level	**Uninterrupted or Interrupted Flow**			**All**	
Good	> 0.77^ > 0.33*	< 1.15^ < 1.30*	< 1.30^ < 3.00*	< 44.18	> 16.5
Fair	0.67 - 0.77^ 0.17 - 0.33*	1.15 -1.33^ 1.30 - 2.00*	1.30 - 1.50^ 3.00-6.00*	44.18 -124.86	16.0 - 16.5
Poor	< 0.67^ < 0.17*	> 1.33^ > 2.00*	> 1.50^ > 6.00*	> 124.86	< 16.0

[1]Urban Operating Environment
[2]Rural Operating Environment
^Uninterrupted Flow Facility
*Interrupted Flow Facility

Figure 16: Freight Performance



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Freight Index and Hot Spots
2014 Data

2.7 Corridor Performance Summary

Based on the results presented in the preceding sections, the following general observations were made related to the performance of the SR 87/SR 260/SR 377 corridor:

- Overall Performance: The Pavement, Bridge, and Mobility performance areas show generally "good" or "fair" performance; Safety and Freight performance areas show generally "poor/below average" or "fair/average" performance
- Pavement Performance: The weighted average of the Pavement Index shows "good" overall performance; exceptions include Segments 260-13, 277-14, and 77-16, which show either "poor" or "fair" performance for the Pavement Index, Directional Pavement Serviceability Rating (PSR), and % Area Failure measures; no data was available for Segment 40B-17
- Bridge Performance: The weighted average of the Bridge Index shows "good" overall performance; all segments that include bridges have "good" or "fair" performance for Bridge Index, Sufficiency Rating, and Lowest Bridge Rating measures; Segment 77-16 shows "poor" performance for the % of Deck Area on Functionally Obsolete Bridges; Segments 87-6, 87-7, 260-8, 260-9, 277-14, 377-15, and 40B-17 contain no bridges
- Mobility Performance: The weighted average of the Mobility Index shows "good" overall performance; Closure Extent, Directional Planning Time Index (PTI), % Bicycle Accommodation, and % Non-Single Occupancy Vehicle (SOV) Trips show "poor" or "fair" performance for the corridor; Segments 87-2, 87-7, 260-9, and 77-16 show either "poor" or "fair" performance in the Mobility Index and Future Daily V/C measures
- Safety Performance: The weighted average of the Safety Index and Directional Safety Index show "below average" overall performance; in the 2010-2014 analysis period, there were 48 fatal crashes and 81 incapacitating crashes on the corridor; Segments 87-7, 260-9, 260-13, 277-14, 77-16, and 40B-17 have "insufficient data", meaning that there was not enough data available to generate reliable performance ratings so no values were calculated
- Freight Performance: The weighted average of the Freight Index shows "poor" performance; Closure Duration, Directional Truck Travel Time Index (TTTI), and Directional Truck PTI show "poor" or "fair" performance for the corridor; no TTTI or TPTI data was available for Segments 277-14 and 377-15; no Closure Duration data was available for Segment 40B-17
- Lowest Performing Segments: Segments 87-3, 87-4, 260-9, and 77-16 show "poor/below average" performance for many performance measures
- Highest Performing Segments: Segments 87-2 and 87-7 show "good/above average" performance for many performance measures

Figure 17 shows the percentage of the SR 87/SR 260/SR 377 corridor that rates either "good/above average performance", "fair/average performance", or "poor/below average performance" for each primary measure. On the SR 87/SR 260/SR 377 corridor, Freight is the lowest performing area with 69% of the corridor in "poor" condition as it relates to the primary measure. Pavement and Mobility are the highest performing areas along the SR 87/SR 260/SR 377 corridor with 93% and 91% of the corridor, respectively, in "good" condition as it relates to the primary measures.

Table 10 shows a summary of corridor performance for all primary measures and secondary measure indicators for the SR 87/SR 260/SR 377 corridor. A weighted corridor average rating (based on the length of the segment) was calculated for each primary and secondary measure. The weighted average ratings are summarized in **Figure 18** which also provides a brief description of each performance measure. **Figure 18** represents the average for the entire corridor and any given segment or location could have a higher or lower rating than the corridor average.

Figure 17: Performance Summary by Primary Measure

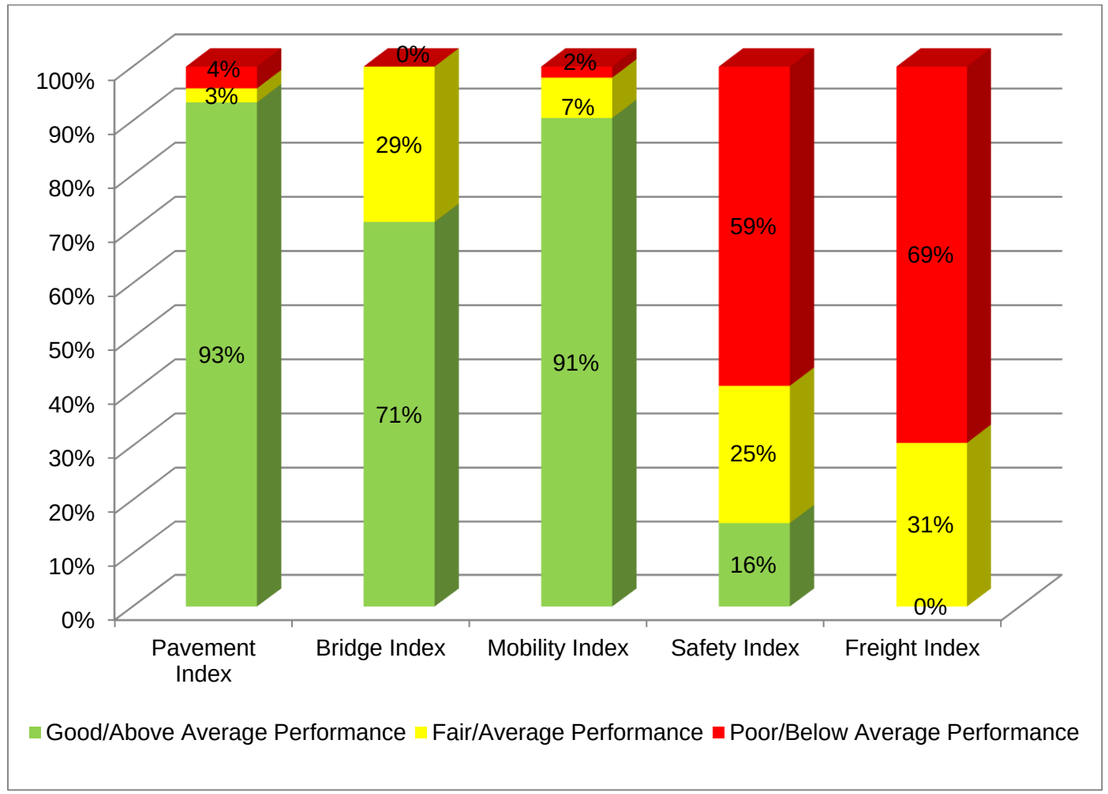


Figure 18: Corridor Performance Summary by Performance Measure

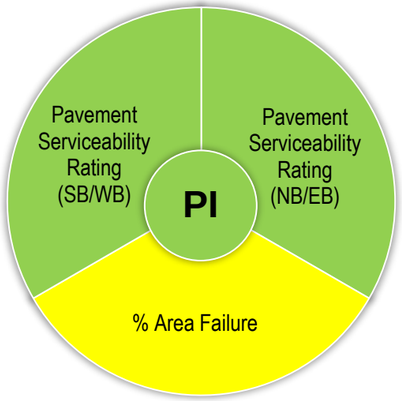
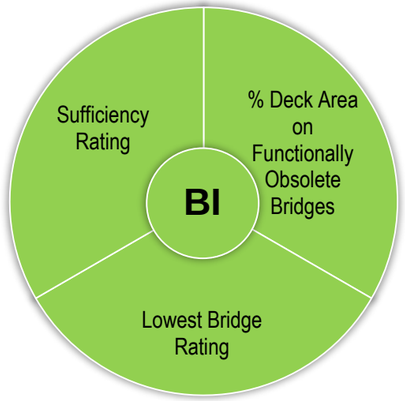
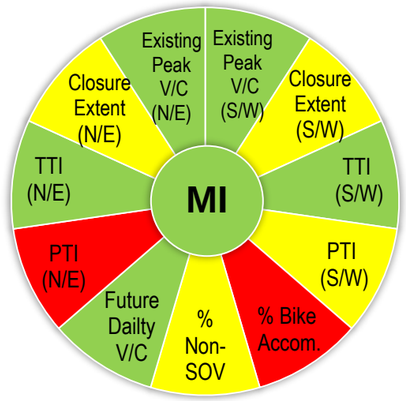
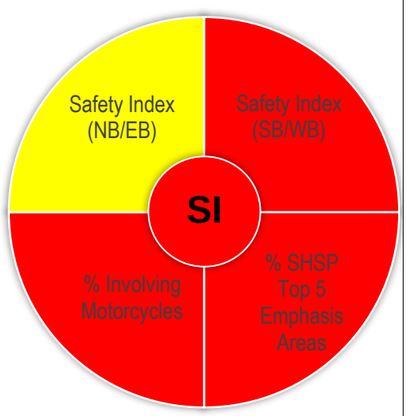
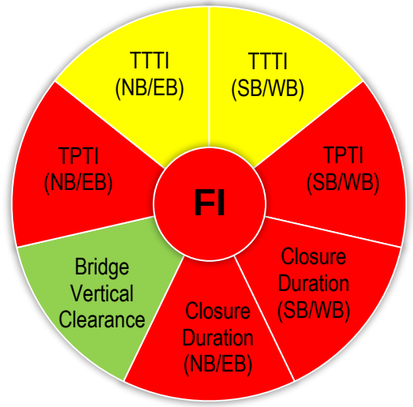
Pavement	Bridge	Mobility	Safety	Freight
				
Pavement Index (PI): based on two pavement condition ratings from the ADOT Pavement Database; the two ratings are the International Roughness Index (IRI) and the Cracking Rating	**Bridge Index (BI):** based on four bridge condition ratings from the ADOT Bridge Database; the four ratings are the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating	**Mobility Index (MI):** an average of the existing daily volume-to-capacity (V/C) ratio and the projected 2035 daily V/C ratio	**Safety Index (SI):** combines the bi-directional frequency and rate of fatal and incapacitating injury crashes, compared to crash occurrences on similar roadways in Arizona	**Freight Index (FI):** a reliability performance measure based on the bi-directional planning time index for truck travel
➢ **Directional Pavement Serviceability Rating (PSR)** – the weighted average (based on number of lanes) of the PSR for the pavement in each direction of travel ➢ **% Area Failure** – the percentage of pavement area rated above failure thresholds for IRI or Cracking	➢ **Sufficiency Rating**– multipart rating includes structural adequacy and safety factors as well as functional aspects such as traffic volume and length of detour ➢ **% of Deck Area on Functionally Obsolete Bridges**– the percentage of deck area in a segment that is on functionally obsolete bridges; identifies bridges that no longer meet standards for current traffic volumes, lane width, shoulder width, or bridge rails; a bridge that is functionally obsolete may still be structurally sound ➢ **Lowest Bridge Rating** –the lowest rating of the four bridge condition ratings on each segment	➢ **Future Daily V/C** – the future 2035 V/C ratio provides a measure of future congestion if no capacity improvements are made to the corridor ➢ **Existing Peak Hour V/C** – the existing peak hour V/C ratio for each direction of travel provides a measure of existing peak hour congestion during typical weekdays ➢ **Closure Extent** – the average number of instances a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel ➢ **Directional Travel Time Index (TTI)** – the ratio of the average peak period travel time to the free-flow travel time; the TTI represents recurring delay along the corridor ➢ **Directional Planning Time Index (PTI)** – the ratio of the 95th percentile travel time to the free-flow travel time; the PTI represents non-recurring delay along the corridor ➢ **% Bicycle Accommodation** – the percentage of a segment that accommodates bicycle travel ➢ **% Non-single Occupancy Vehicle (Non-SOV) Trips** –the percentage of trips that are taken by vehicles carrying more than one occupant	➢ **Directional Safety Index** – the combination of the directional frequency and rate of fatal and incapacitating injury crashes, compared to crash occurrences on similar roadways in Arizona ➢ **% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors** – the percentage of fatal and incapacitating crashes that involve at least one of the five Strategic Highway Safety Plan (SHSP) emphasis areas on a given segment compared to the statewide average percentage on roads with similar operating environments ➢ **% of Fatal + Incapacitating Crashes Involving SHSP Crash Unit Types** – the percentage of total fatal and incapacitating injury crashes that involves a given crash unit type (motorcycle, truck, non-motorized traveler) compared to the statewide average percentage on roads with similar operating environments	➢ **Directional Truck Travel Time Index (TTTI)** – the ratio of the average peak period truck travel time to the free-flow truck travel time; the TTTI represents recurring delay along the corridor ➢ **Directional Truck Planning Time Index (TPTI)** – the ratio the 95th percentile truck travel time to the free-flow truck travel time; the TPTI represents non-recurring delay along the corridor ➢ **Closure Duration** – the average time a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel ➢ **Bridge Vertical Clearance** – the minimum vertical clearance over the travel lanes for underpass structures on each segment.

Table 10: Corridor Performance Summary by Segment and Performance Measure

Segment #	Segment Length (miles)	Pavement Performance Area				Bridge Performance Area				Mobility Performance Area											
		Pavement Index	Directional PSR		% Area Failure	Bridge Index	Sufficiency Rating	% of Deck Area on Functionally Obsolete Bridges	Lowest Bridge Rating	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/ milepost/year/mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips
			NB/EB	SB/WB								NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB		
87-1[1*a]	5	4.19	4.03	4.11	10.0%	7.00	85.00	0.0%	7	0.65	0.86	0.34	0.34	0.37	0.32	1.22	1.06	4.01	3.03	45%	13.6%
87-2[1* a]	9	4.25	4.01	4.14	0.0%	7.00	96.50	0.0%	7	0.73	1.01	0.45	0.45	0.46	0.04	1.15	1.23	2.36	3.86	93%	14.4%
87-3[2^ a]	22	3.80	3.80	3.88	11.4%	6.95	96.20	0.0%	6	0.21	0.29	0.14	0.13	0.87	0.11	1.05	1.04	1.54	1.48	99%	16.7%
87-4[2^ a]	22	4.05	3.84	3.93	0.0%	6.31	89.18	0.0%	6	0.23	0.27	0.20	0.21	1.47	0.15	1.17	1.05	2.05	1.47	86%	5.2%
87-5[2^ a]	5	4.55	4.35	4.36	0.0%	6.31	99.60	0.0%	6	0.15	0.14	0.15	0.15	0.23	0.07	1.01	1.08	1.42	1.51	92%	12.9%
87-6[2^ a]	10	4.15	4.10	3.96	0.0%	No Bridges				0.21	0.21	0.19	0.19	0.18	0.27	1.31	1.15	2.38	1.94	79%	12.4%
87-7[1* b]	2	3.54	3.36	3.48	0.0%	No Bridges				0.75	0.94	0.57	0.50	0.07	0.20	1.18	1.86	4.43	6.48	56%	18.4%
260-8[1* b]	4	4.31	4.24		0.0%	No Bridges				0.54	0.68	0.47	0.51	0.05	0.00	1.46	1.10	7.15	4.97	16%	18.5%
260-9[2^ c]	3	4.27	4.12		0.0%	No Bridges				0.94	1.15	1.29	1.33	0.30	0.55	1.12	1.00	1.61	1.16	2%	15.1%
260-10[2^ a]	17	4.03	3.79	3.81	0.0%	6.81	99.52	0.0%	6	0.08	0.08	0.13	0.11	0.49	0.48	1.13	1.06	1.64	1.40	93%	16.2%
260-11[2^ c]	5	4.13	3.98		0.0%	6.73	79.13	0.0%	6	0.12	0.14	0.14	0.13	0.40	0.88	1.23	1.00	2.16	1.14	49%	12.5%
260-12[2^ c]	22	3.78	3.52		4.5%	7.00	98.40	0.0%	7	0.36	0.39	0.34	0.34	0.43	0.85	1.00	1.05	1.18	1.36	2%	10.8%
260-13[1^ b]	2	3.11	2.87		50.0%	6.00	93.70	0.0%	6	0.14	0.15	0.14	0.14	0.00	0.40	1.02	1.21	1.63	2.98	15%	6.7%
277-14[2^ c]	7	2.05	3.03		71.4%	No Bridges				0.09	0.10	0.07	0.06	0.11	0.00	No Data				0%	17.5%
377-15[2^ c]	34	4.12	4.03		0.0%	No Bridges				0.09	0.10	0.13	0.13	0.04	0.05	No Data				0%	18.2%
77-16[1* c]	2	3.25	3.10		40.0%	6.00	59.00	100.0%	6	0.85	1.09	0.60	0.65	0.00	0.00	1.08	1.49	3.84	6.79	1%	18.7%
40B-17[1* b]	1	No Data				No Bridges				0.45	0.57	0.32	0.32	No Data		1.80	1.31	12.93	10.56	27%	20.7%
Weighted Corridor Average		3.94	3.83	3.86	6.4%	6.70	95.46	1.6	6.06	0.26	0.32	0.24	0.23	0.49	0.27	1.13	1.09	2.15	2.03	49%	14.0%

SCALES

Performance Level	Non-Interstate		All				Urban and Fringe Urban	All	Uninterrupted		All	
Good/Above Average	> 3.50	< 5%	> 6.5	> 80	< 12%	> 6	< 0.71	< 0.22	< 1.15	< 1.3	> 90%	> 17%
Fair/Average	2.90 - 3.50	5% - 20%	5.0 - 6.5	50 - 80	12% - 40%	5 - 6	0.71 - 0.89	0.22 - 0.62	1.15 - 1.33	1.3 - 1.5	60% - 90%	11% - 17%
Poor/Below Average	< 2.90	> 20%	< 5.0	< 50	> 40%	< 5	> 0.89	> .62	> 1.33	> 1.5	< 60%	< 11%

Performance Level	Rural	Interrupted	
Good/Above Average	< 0.56	< 1.3	< 3.0
Fair/Average	0.56 - 0.76	1.3 – 2.0	3.0 – 6.0
Poor/Below Average	> 0.76	> 2.0	> 6.0

^Uninterrupted Flow Facility
*Interrupted Flow Facility

[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway

[1]Urban Operating Environment
[2]Rural Operating Environment

Table 10: Corridor Performance Summary by Segment and Performance Measure (continued)

Segment #	Segment Length (miles)	Safety Performance Area							Freight Performance Area							
		Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	% of Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers	Freight Index	Directional TTTI		Directional TPTI		Closure Duration (minutes/milepost/year/mile)		Bridge Vertical Clearance (feet)
			NB/EB	SB/WB						NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	
87-1[1]*	5	3.01	4.05	1.98	29%	Insufficient Data	Insufficient Data	Insufficient Data	0.28	1.29	1.10	3.88	3.38	129.19	61.92	No UP
87-2[1]*	9	0.62	1.21	0.04	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.29	1.19	1.32	2.72	4.06	119.84	147.44	No UP
87-3[2]^	22	1.19	0.48	1.90	44%	Insufficient Data	39%	Insufficient Data	0.53	1.11	1.23	1.38	2.38	2674.13	59.23	16.97
87-4[2]^	22	1.62	1.48	1.76	30%	Insufficient Data	50%	Insufficient Data	0.51	1.37	1.14	2.38	1.56	4359.89	34.01	18.75
87-5[2]^	5	1.22	0.08	2.36	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.56	1.12	1.21	1.45	2.13	49.20	21.67	No UP
87-6[2]^	10	2.11	0.09	4.13	71%	Insufficient Data	14%	Insufficient Data	0.44	1.55	1.22	2.52	2.01	37.16	287.98	No UP
87-7[1]*	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.28	1.20	1.91	3.29	3.88	21.33	693.60	No UP
260-8[1]*	4	0.28	0.56	0.00	43%	Insufficient Data	Insufficient Data	Insufficient Data	0.15	1.66	1.17	9.64	4.11	11.45	0.00	No UP
260-9[2]^	3	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.47	1.20	1.00	3.09	1.21	71.85	726.90	No UP
260-10[2]^	17	0.93	0.62	1.24	50%	Insufficient Data	13%	Insufficient Data	0.58	1.23	1.12	1.82	1.61	157.49	797.71	No UP
260-11[2]^	5	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.54	1.45	1.00	2.53	1.18	144.40	922.04	No UP
260-12[2]^	22	1.43	2.25	0.62	46%	Insufficient Data	15%	Insufficient Data	0.69	1.00	1.10	1.19	1.69	117.01	901.62	No UP
260-13[1]^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.36	1.09	1.35	2.75	2.82	0.00	739.30	No UP
277-14[2]^	7	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	No Data					20.03	0.00	No UP
377-15[2]^	34	1.18	1.21	1.16	82%	Insufficient Data	0%	Insufficient Data	No Data					10.14	9.29	No UP
77-16[1]*	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.22	1.12	1.54	3.52	5.65	0.00	0.00	No UP
40B-17[1]*	1	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.05	2.15	1.51	29.93	8.45	No Data		No UP
Weighted Corridor Average		1.32	1.20	1.45	54%	Insufficient Data	21%	Insufficient Data	0.50	1.24	1.18	2.46	2.25	957.0	289.9	17.87

SCALES

Performance Level	2 or 3 or 4 Lane Divided Highway					Uninterrupted			All	
Good/Above Average	< 0.77	< 44%	< 4%	< 16%	< 2%	> 0.77	< 1.15	< 1.3	< 44.18	> 16.5
Fair/Average	0.77 - 1.23	44% - 54%	4% - 7%	16% - 26%	2% - 4%	0.67 - 0.77	1.15 - 1.33	1.3 - 1.5	44.18-124.86	16.0 - 16.5
Poor/Below Average	> 1.23	> 54%	> 7%	> 26%	> 4%	< 0.67	> 1.33	> 1.5	> 124.86	< 16.0
Performance Level	**2 or 3 Lane Undivided Highway**					**Interrupted**				
Good/Above Average	< 0.94	< 51%	< 6%	< 19%	< 5%	> 0.33	< 1.3	< 3.0		
Fair/Average	0.94 - 1.06	51% - 58%	6% - 10%	19% - 27%	5% - 8%	0.17 - 0.33	1.3 - 2.0	3.0 - 6.0		
Poor/Below Average	> 1.06	> 58%	> 10%	> 27%	> 8%	< 0.17	> 2.0	> 6.0		
Performance Level	**4 or 5 Undivided Highway**									
Good/Above Average	< 0.80	< 42%	< 6%	< 6%	< 5%					
Fair/Average	0.80 - 1.20	42% - 51%	6% - 10%	6% - 9%	5% - 8%					
Poor/Below Average	> 1.20	> 51%	> 10%	> 9%	> 8%					

^Uninterrupted Flow Facility
*Interrupted Flow Facility

[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway

[1]Urban Operating Environment
[2]Rural Operating Environment

Notes: "Insufficient Data" indicates there was not enough data available to generate reliable performance ratings
"No UP" indicates no underpasses are present in the segment

3.0 NEEDS ASSESSMENT

3.1 Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP), 2010-2035. Statewide performance goals that are relevant to SR 87/SR 260/SR 377 performance areas were identified and corridor goals were then formulated for each of the five performance areas that aligned with the overall statewide goals established by the LRTP. Based on stakeholder input, corridor goals, corridor objectives, and performance results, three "emphasis areas" were identified for the SR 87/SR 260/SR 377 corridor: Mobility, Safety and Freight.

Taking into account the corridor goals and identified emphasis areas, performance objectives were developed for each quantifiable performance measure that identify the desired level of performance based on the performance scale levels for the overall corridor and for each segment of the corridor. For the performance emphasis areas, the corridor-wide weighted average performance objectives are identified with a higher standard than for the other performance areas. **Table 11** shows the SR 87/SR 260/SR 377 corridor goals, corridor objectives, and performance objectives, and how they align with the statewide goals.

It is not reasonable within a financially constrained environment to expect that every performance measure will always be at the highest levels on every corridor segment. Therefore, individual corridor segment objectives have been set as "fair/average" or better and should not fall below that standard.

Achieving corridor and segment performance objectives will help ensure that investments are targeted toward improvements that support the safe and efficient movement of travelers on the corridor. Addressing current and future congestion, thereby improving mobility on congested segments, will also help the corridor fulfill its potential as a significant contributor to the region's economy.

Corridor performance is measured against corridor and segment objectives to determine needs – the gap between observed performance and performance objectives.

Goal achievement will improve or reduce current and future congestion, increase travel time reliability, and reduce fatalities and incapacitating injuries resulting from vehicle crashes. Where performance is currently rated "good", the goal is always to maintain that standard, regardless of whether or not the performance is in an emphasis area.

Table 11: Corridor Performance Goals and Objectives

ADOT Statewide LRTP Goals	SR 87/SR 260/SR 377 Corridor Goals	SR 87/SR 260/SR 377 Corridor Objectives	Performance Area	Primary Measure	Performance Objective	
				Secondary Measure Indicators	Corridor Average	Segment
Improve Mobility and Accessibility	Improve mobility through additional capacity and improved roadway geometry Provide a safe and reliable route for recreational and tourist travel Provide a safe, reliable and efficient connection to all communities along the corridor to permit efficient regional travel	Reduce current congestion and plan to facilitate future congestion that accounts for anticipated growth and land use changes Reduce delays from recurring and non-recurring events to improve reliability, especially in Payson and Holbrook Improve bicycle and pedestrian accommodations	Mobility (*Emphasis Area*)	Mobility Index Future Daily V/C Existing Peak Hour V/C Closure Extent Directional Travel Time Index Directional Planning Time Index % Bicycle Accommodation % Non-SOV Trips	Good	Fair or better
Support Economic Growth	Provide a safe, reliable and efficient freight route	Reduce delays and restrictions to freight movement to improve reliability Improve travel time reliability (including impacts to motorists due to freight traffic)	Freight *(Emphasis Area)*	Freight Index Directional Truck Travel Time Index Directional Truck Planning Time Index Closure Duration Bridge Vertical Clearance	Good	Fair or better
Preserve and Maintain the State Transportation System	Preserve and modernize highway infrastructure	Maintain structural integrity of bridges	Bridge	Bridge Index Sufficiency Rating % of Deck Area on Functionally Obsolete Bridges Lowest Bridge Rating	Fair or better	Fair or better
		Improve pavement ride quality for all corridor users Reduce long-term pavement maintenance costs	Pavement	Pavement Index Directional Pavement Serviceability Rating % Area Failure	Fair or better	Fair or better
Enhance Safety and Security	Provide a safe, reliable, and efficient connection for the communities along the corridor Promote safety by implementing appropriate countermeasures	Reduce fatal and incapacitating injury crashes for all roadway users	Safety *(Emphasis Area)*	Safety Index Directional Safety Index % of Crashes Involving SHSP Top 5 Emphasis Areas Behaviors % of Crashes Involving Crash Unit Types	Above Average	Average or better

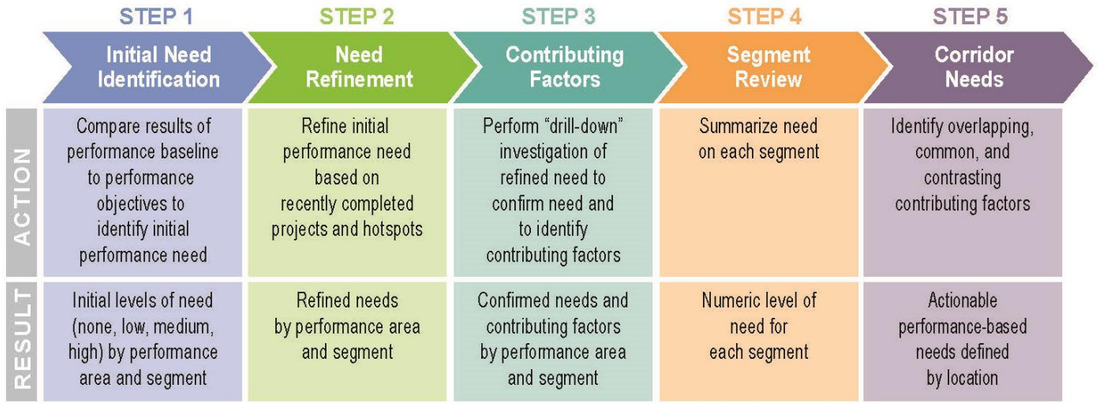
3.2 Needs Assessment Process

The following guiding principles were used as an initial step in developing a framework for the performance-based needs assessment process:

- Corridor needs are defined as the difference between the corridor performance and the performance objectives
- The needs assessment process should be systematic, progressive, and repeatable, but also allow for engineering judgment where needed
- The process should consider all primary and secondary performance measures developed for the study
- The process should develop multiple need levels including programmatic needs for the entire length of the corridor, performance area-specific needs, segment-specific needs, and location-specific needs (defined by MP limits)
- The process should produce actionable needs that can be addressed through strategic investments in corridor preservation, modernization, and expansion

The performance-based needs assessment process is illustrated in **Figure 19** and described in the following sections.

Figure 19: Needs Assessment Process



Step 1: Initial Needs Identification

The first step in the needs assessment process links baseline (existing) corridor performance with performance objectives. In this step, the baseline corridor performance is compared to the performance objectives to provide a starting point for the identification of performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process is shown below in **Figure 20**.

Figure 20: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)

Performance Thresholds	Performance Level	Initial Level of Need	Description
6.5	Good	None*	All levels of Good and top 1/3 of Fair (>6.0)
	Good		
	Good		
	Fair		
	Fair	Low	Middle 1/3 of Fair (5.5-6.0)
5.0	Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor (4.5-5.5)
	Poor		
	Poor	High	Lower 2/3 of Poor (<4.5)
	Poor		

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

The initial level of need for each segment is refined to account for hot spots and recently completed or under construction projects, resulting in a final level of need for each segment. The final levels of need for each primary and secondary performance measure are combined to produce a weighted final need rating for each segment. Values of 0, 1, 2, and 3 are assigned to the initial need levels of None, Low, Medium, and High, respectively. A weight of 1.0 is applied to the Performance Index need and equal weights of 0.20 are applied to each need for each secondary performance measure. For directional secondary performance measures, each direction of travel receives a weight of 0.10.

Step 2: Need Refinement

In Step 2, the initial level of need for each segment is refined using the following information and engineering judgment:

- For segments with an initial level of need of None that contain hot spots, the level of need should be increased from None to Low
- For segments with an initial level of need where recently completed projects or projects under construction are anticipated to partially or fully address the identified need, the level of need should be reduced or eliminated as appropriate
- Programmed projects that are expected to partially or fully address an identified need are not justification to lower the initial need because the programmed projects may not be

implemented as planned; in addition, further investigations may suggest that changes in the scope of a programmed project may be warranted

The resulting final needs are carried forward for further evaluation in Step 3.

Step 3: Contributing Factors

In Step 3, a more detailed review of the condition and performance data available from ADOT is conducted to identify contributing factors to the need. Typically, the same databases used to develop the baseline performance serve as the principal sources for the more detailed analysis. However, other supplemental databases may also be useful sources of information. The databases used for diagnostic analysis are listed below:

Pavement Performance Area

- Pavement Rating Database

Bridge Performance Area

- ABISS

Mobility Performance Area

- Highway Performance Monitoring System (HPMS) Database
- AZTDM
- Real-time traffic conditions data produced by American Digital Cartography Inc. (HERE) Database
- Highway Conditions Reporting System (HCRS) Database

Safety Performance Area

- Crash Database

Freight Performance Area

- HERE Database
- HCRS Database

In addition, other sources were considered to help identify the contributing factors such as:

- Maintenance history (from ADOT PeCoS database for pavement), the level of past investments, or trends in historical data that provide context for pavement and bridge history
- Field observations from ADOT district personnel can be used to provide additional information regarding a need that has been identified
- Previous studies can provide additional information regarding a need that has been identified

Step 3 results in the identification of performance-based needs and contributing factors by segment (and MP locations, if appropriate) that can be addressed through investments in preservation, modernization, and expansion projects to improve corridor performance. See **Appendix D** for more information.

Step 4: Segment Review

In this step, the needs identified in Step 2 and refined in Step 3 are quantified for each segment to numerically estimate the level of need for each segment. Values of 0 to 3 are assigned to the final need levels (from Step 3) of None, Low, Medium, and High, respectively. A weighting factor is applied to the performance areas identified as emphasis areas and a weighted average need is calculated for each segment. The resulting average need score can be used to compare levels of need between segments within a corridor and between segments in different corridors.

Step 5: Corridor Needs

In this step, the needs and contributing factors for each performance area are reviewed on a segment-by-segment basis to identify actionable needs and to facilitate the formation of solution sets that address multiple performance areas and contributing factors. The intent of this process is to identify overlapping, common, and contrasting needs to help develop strategic solutions. This step results in the identification of corridor needs by specific location.

3.3 Corridor Needs Assessment

This section documents the results of the needs assessment process described in the prior section. The needs in each performance area were classified as either None, Low, Medium, or High based on how well each segment performed in the existing performance analysis. The needs for each segment were numerically combined to estimate the average level of need for each segment of the corridor

The final needs assessments for each performance measure, along with the scales used in analysis, are shown in **Table 12** through **Table 16**.

Pavement Needs Refinement and Contributing Factors

- The level of need in Segment 87-1 was increased from None to Low due to the presence of a hot spot
- The level of need in Segment 87-4 was increased from None to Low due to the presence of a hot spot
- With pavement rating data not available in Segment 40B-17, a field review was conducted to provide an estimated level of need of Low based on visual observation of pavement condition
- See **Appendix D** for detailed information on contributing factors

Table 12: Final Pavement Needs

Segment #	Performance Score and Level of Need				Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Pavement Index	Directional PSR		% Area Failure				
		NB	SB					
87-1	4.19	4.03	4.11	10.00%	0.0	NB MP 177-178	None	Low
87-2	4.25	4.01	4.14	0.00%	0.0	None	None	None
87-3	3.80	3.80	3.88	11.36%	0.2	SB MP 195-199, SB MP 200-201	None	Low
87-4	4.05	3.84	3.93	0.00%	0.0	MP 224-226	None	Low
87-5	4.55	4.35	4.36	0.00%	0.0	None	None	None
87-6	4.15	4.10	3.96	0.00%	0.0	None	None	None
87-7	3.54	3.36	3.48	0.00%	0.0	None	None	None
260-8	4.31	4.24	4.24	0.00%	0.0	None	None	None
260-9	4.27	4.12	4.12	0.00%	0.0	None	None	None
260-10	4.03	3.79	3.81	0.00%	0.0	None	None	None
260-11	4.13	3.98	3.98	0.00%	0.0	None	None	None
260-12	3.78	3.52	3.52	4.55%	0.0	NB MP 288-289	Spot repair pavement preservation project for MP 282-290 is currently underway that will address the identified hot spot	None
260-13	3.11	2.87	2.87	50.00%	2.0	NB MP 304-305	None	Medium
277-14	2.05	3.03	3.03	71.43%	4.0	NB MP 307-310, NB MP 311-313	None	High
377-15	4.12	4.03	4.03	0.00%	0.0	None	None	None
77-16	3.25	3.10	3.10	40.00%	1.8	NB MP 388-389	None	Medium
40B-17	No Data				N/A	None	None	Low

Level of Need (Score)	Performance Score Need Scale		Segment Level Need Scale
None* (0)	> 3.30	< 10%	0
Low (1)	3.10 - 3.30	10% - 15%	< 1.5
Medium (2)	2.70 - 3.10	15% - 25%	1.5 - 2.5
High (3)	< 2.70	> 25%	> 2.5

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Bridge Needs Refinement and Contributing Factors

- There are no bridges along the corridor with potential historical investment issues
- There were no recently completed bridge projects or hot spots along the corridor
- See **Appendix D** for detailed information on contributing factors

Table 13: Final Bridge Needs

Segment #	Performance Score and Level of Need				Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Bridge Index	Sufficiency Rating	% of Deck on Functionally Obsolete Bridges	Lowest Bridge Rating				
87-1	7.00	85.0	0.0%	7	0.0	None	None	None
87-2	7.00	96.5	0.0%	7	0.0	None	None	None
87-3	6.95	96.2	0.0%	6	0.0	None	None	None
87-4	6.31	89.2	0.0%	6	0.0	None	None	None
87-5	6.31	99.6	0.0%	6	0.0	None	None	None
87-6	No Bridges				None	None	None	None
87-7	No Bridges				None	None	None	None
260-8	No Bridges				None	None	None	None
260-9	No Bridges				None	None	None	None
260-10	6.81	99.5	0.0%	6	0.0	None	None	None
260-11	6.73	79.1	0.0%	6	0.0	None	None	None
260-12	7.00	98.4	0.0%	7	0.0	None	None	None
260-13	6.00	93.7	0.0%	6	0.0	None	None	None
277-14	No Bridges				None	None	None	None
377-15	No Bridges				None	None	None	None
77-16	6.00	59.0	100%	6	0.7	None	None	Low
40B-17	No Bridges				None	None	None	None

Level of Need (Score)	Performance Score Need Scale				Segment Level Need Scale
None (0)	> 6.0	> 70	> 5.0	< 21.0%	0
Low (1)	5.5 - 6.0	60 - 70	5.0	21.0% - 31.0%	< 1.5
Medium (2)	4.5 - 5.5	40 - 60	4.0	31.0% - 49.0%	1.5 - 2.5
High (3)	< 4.5	< 40	< 4.0	> 49.0%	> 2.5

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Mobility Needs Refinement and Contributing Factors

- There were no recently completed mobility projects along the corridor
- See **Appendix D** for detailed information on contributing factors

Table 14: Final Mobility Needs

Segment #	Performance Score and Level of Need											Initial Segment Need	Recently Completed Projects	Final Segment Need
	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent		Directional TTI		Directional PTI		% Bicycle Accommodation			
			NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB				
87-1[b]	0.65	0.86	0.34	0.34	0.37	0.32	1.22	1.06	4.01	3.03	45%	1.2	None	Low
87-2[b]	0.73	1.01	0.45	0.45	0.46	0.04	1.15	1.23	2.36	3.86	93%	0.7	None	Low
87-3[a]	0.21	0.29	0.14	0.13	0.87	0.11	1.05	1.04	1.54	1.48	99%	0.7	None	Low
87-4[a]	0.23	0.27	0.20	0.21	1.47	0.15	1.17	1.05	2.05	1.47	86%	0.8	None	Low
87-5[a]	0.15	0.14	0.15	0.15	0.23	0.07	1.01	1.08	1.42	1.51	92%	0.3	None	Low
87-6[a]	0.21	0.21	0.19	0.19	0.18	0.27	1.31	1.15	2.38	1.94	79%	1	None	Low
87-7[b]	0.75	0.94	0.57	0.50	0.07	0.20	1.18	1.86	4.43	6.48	56%	1.3	None	Low
260-8[b]	0.54	0.68	0.47	0.51	0.05	0.00	1.46	1.10	7.15	4.97	16%	1	None	Low
260-9[a]	0.94	1.15	1.29	1.33	0.30	0.55	1.12	1.00	1.61	1.16	2%	5.3	None	High
260-10[a]	0.08	0.08	0.13	0.11	0.49	0.48	1.13	1.06	1.64	1.40	93%	0.7	None	Low
260-11[a]	0.12	0.14	0.14	0.13	0.40	0.88	1.23	1.00	2.16	1.14	49%	1.4	None	Low
260-12[a]	0.36	0.39	0.34	0.34	0.43	0.85	1.00	1.05	1.18	1.36	2%	1	None	Low
260-13[a]	0.14	0.15	0.14	0.14	0.00	0.40	1.02	1.21	1.63	2.98	15%	1.3	None	Low
277-14[a]	0.09	0.10	0.07	0.06	0.11	0.00	*No Data*				0%	0.6	None	Low
377-15[a]	0.09	0.10	0.13	0.13	0.04	0.05	*No Data*				0%	0.6	None	Low
77-16[b]	0.85	1.09	0.60	0.65	0.00	0.00	1.08	1.49	3.84	6.79	1%	3.4	None	High
40B-17[b]	0.45	0.57	0.32	0.32	*No Data*		1.80	1.31	12.93	10.56	27%	1.4	None	Low

Level of Need (Score)	Performance Score Need Scale					Segment Level Need Scale
None* (0)	≤ 0.77 (Urban) ≤ 0.63 (Rural)	< 0.35	< 1.21[a] < 1.53[b]	< 1.37[a] < 4.00[b]	> 80%	0
Low (1)	0.77 - 0.83 (Urban) 0.63 - 0.69 (Rural)	0.35 - 0.49	1.21 - 1.27[a] 1.53 - 1.77[b]	1.37 - 1.43[a] 4.00 - 5.00[b]	70% - 80%	< 1.5
Medium (2)	0.83 - 0.95 (Urban) 0.69 - 0.83 (Rural)	0.49 - 0.75	1.27 - 1.39[a] 1.77 - 2.23[b]	1.43 - 1.57[a] 5.00 - 7.00[b]	50% - 70%	1.5 - 2.5
High (3)	≥ 0.95 (Urban) ≥ 0.83 (Rural)	> 0.75	> 1.39[a] > 2.23[b]	> 1.57[a] > 7.00[b]	< 50%	> 2.5

a: Uninterrupted
b: Interrupted

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Safety Needs Refinement and Contributing Factors

- Segment 260-8 includes a hot spot so the final segment need was raised from None to Low
- Safety hot spots are also present in Segments 87-4 and 87-6, which already have a High Safety segment need

See **Appendix D** for detailed information on contributing factors

Table 15: Final Safety Needs

Segment #	Performance Score and Level of Need							Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Area Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	% of Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers				
		NB/EB	SB/WB								
87-1[a]	3.01	4.05	1.98	29%	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	3.6	None	None	High
87-2[a]	0.62	1.21	0.04	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	0.2	None	None	Low
87-3[a]	1.19	0.48	1.90	44%	*Insufficient Data*	39%	*Insufficient Data*	2.9	None	None	High
87-4[a]	1.62	1.48	1.76	30%	*Insufficient Data*	50%	*Insufficient Data*	4.2	NB, MP 213-215	None	High
87-5[a]	1.22	0.08	2.36	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	2.3	None	Signage, rumble strips, and turn lanes added in 2016 at SR 87/SR 188 intersection	Medium
87-6[a]	2.11	0.09	4.13	71%	*Insufficient Data*	14%	*Insufficient Data*	3.9	SB, MP 245-248	None	High
87-7[b]	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	N/A	None	None	N/A
260-8[b]	0.28	0.56	0.00	43%	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	0.0	EB, MP 252-253	None	Low
260-9[c]	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	N/A	None	None	N/A
260-10[a]	0.93	0.62	1.24	50%	*Insufficient Data*	13%	*Insufficient Data*	1.4	None	None	Low
260-11[c]	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	N/A	None	None	N/A
260-12[c]	1.43	2.25	0.62	46%	*Insufficient Data*	15%	*Insufficient Data*	3.3	None	Spot repair pavement preservation project, 2016, MP 282-291	High
260-13[b]	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	N/A	None	None	N/A
277-14[c]	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	N/A	None	None	N/A
377-15[c]	1.18	1.21	1.16	82%	*Insufficient Data*	0%	*Insufficient Data*	4.2	None	None	High
77-16[c]	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	N/A	None	None	N/A
40B-17[b]	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	N/A	None	None	N/A

Level of Need (Score)		Performance Score Needs Scale					Segment Level Need Scale
None* (0)	a b c	≤ 0.92 ≤ 0.93 ≤ 0.98	≤ 47% ≤ 45% ≤ 53%	≤ 5% ≤ 7% ≤ 6%	≤ 19% ≤ 7% ≤ 22%	≤ 3% ≤ 6% ≤ 3%	0
Low (1)	a b c	0.92 - 1.07 0.93 - 1.06 0.98 - 1.02	47% - 50% 45% - 48% 53% - 55%	5% - 6% 7% - 8% 6% - 7%	19% - 22% 7% - 8% 22% - 25%	3% - 4% 6% - 7% 3% - 4%	≤ 1.5
Medium (2)	a b c	1.07 - 1.38 1.06 - 1.33 1.02 - 1.10	50% - 57% 48% - 54% 55% - 59%	6% - 8% 8% - 11% 7% - 8%	22% - 29% 8% - 10% 25% - 30%	4% - 5% 7% - 9% 4% - 5%	1.5 - 2.5
High (3)	a b c	≥ 1.38 ≥ 1.33 ≥ 1.10	≥ 57% ≥ 54% ≥ 59%	≥ 8% ≥ 11% ≥ 8%	≥ 29% ≥ 10% ≥ 30%	≥ 5% ≥ 9% ≥ 5%	≥ 2.5

a: 2 or 3 or 4 Lane Divided Highway
b: 4 or 5 Lane Undivided Highway
c: 2 or 3 Lane Undivided Highway

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Freight Needs Refinement and Contributing Factors

- There are no bridge vertical clearance hot spots on the corridor
- See **Appendix D** for detailed information on contributing factors

Table 16: Final Freight Needs

Segment #	Performance Score and Level of Need								Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Freight Index	Directional TTTI		Directional TPTI		Closure Duration		Bridge Vertical Clearance				
		NB	SB	NB	SB	NB	SB					
87-1[b]	0.28	1.29	1.10	3.88	3.38	129.19	61.92	No UP	1.2	None	None	Low
87-2[b]	0.29	1.19	1.32	2.72	4.06	119.84	147.44	No UP	0.5	None	None	Low
87-3[a]	0.53	1.11	1.23	1.38	2.38	2674.13	59.23	16.97	3.8	None	None	High
87-4[a]	0.51	1.37	1.14	2.38	1.56	4359.89	34.01	18.75	4.0	None	MP 227 Construction of NB truck escape ramp (FY 2014), in progress	High
87-5[a]	0.56	1.12	1.21	1.45	2.13	49.20	21.67	No UP	3.6	None	None	High
87-6[a]	0.44	1.55	1.22	2.52	2.01	37.16	287.98	No UP	4.3	None	None	High
87-7[b]	0.28	1.20	1.91	3.29	3.88	21.33	693.60	No UP	0.5	None	None	Low
260-8[b]	0.15	1.66	1.17	9.64	4.11	11.45	0.00	No UP	2.5	None	None	High
260-9[a]	0.47	1.20	1.00	3.09	1.21	71.85	726.90	No UP	3.7	None	None	High
260-10[a]	0.58	1.23	1.12	1.82	1.61	157.49	797.71	No UP	4.3	None	None	High
260-11[a]	0.54	1.45	1.00	2.53	1.18	144.40	922.04	No UP	4.1	None	None	High
260-12[a]	0.69	1.00	1.10	1.19	1.69	117.01	901.62	No UP	2.8	None	None	High
260-13[a]	0.36	1.09	1.35	2.75	2.82	0.00	739.30	No UP	4.1	None	None	High
277-14[a]	*No Data*	*No Data*	*No Data*	*No Data*	*No Data*	20.03	0.00	No UP	N/A	None	None	N/A
377-15[a]	*No Data*	*No Data*	*No Data*	*No Data*	*No Data*	10.14	9.29	No UP	N/A	None	None	N/A
77-16[b]	0.22	1.12	1.54	3.52	5.65	0.00	0.00	No UP	2.3	None	None	Medium
40B-17[b]	0.05	2.15	1.51	29.93	8.45	*No Data*	*No Data*	No UP	3.8	None	None	High

Level of Need (Score)		Performance Score Need Scale					Segment Level Need Scale
None* (0)	a b	≥ 0.74 ≥ 0.28	≤ 1.21 ≤ 1.53	≤ 1.37 ≤ 4.00	≤ 71.07	≥ 16.33	0
Low (1)	a b	0.70 - 0.74 0.22 - 0.28	1.21 - 1.27 1.53 - 1.77	1.37 - 1.43 4.00 - 5.00	71.07 - 97.97	16.17 - 16.33	≤ 1.5
Medium (2)	a b	0.64 - 0.70 0.12 - 0.22	1.27 - 1.39 1.77 - 2.23	1.43 - 1.57 5.00 - 7.00	97.97 - 151.75	15.83 - 16.17	1.5 - 2.5
High (3)	a b	≤ 0.64 ≤ 0.12	≥ 1.39 ≥ 2.23	≥ 1.57 ≥ 7.00	≥ 151.75	≤ 15.83	≥ 2.5

a: Uninterrupted Flow
b: Interrupted Flow

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Segment Review

The needs for each segment were combined to numerically estimate the average level of need for each segment of the corridor. **Table 17** provides a summary of needs for each segment across all performance areas, with the average need score for each segment presented in the last row of the table. A weighting factor of 1.5 is applied to the need scores of the performance areas identified as emphasis areas (Mobility, Safety, and Freight for the SR 87/SR 260/SR 377 corridor). There is one segment with a High average need, fourteen segments with a Medium average need, and two segments with a Low average need.

Table 17: Summary of Needs by Segment

Performance Area	Segment Number and Mileposts (MP)																
	87-1	87-2	87-3	87-4	87-5	87-6	87-7	260-8	260-9	260-10	260-11	260-12	260-13	277-14	377-15	77-16	40B-17^
	MP 177-182	MP 182-191	MP 191-213	MP 213-235	MP 235-241	MP 241-250	MP 250-253	MP 252-256	MP 256-260	MP 260-277	MP 277-282	MP 282-304	MP 304-306	MP 306-313	MP 0-34	MP 386-389	MP 287-288
Pavement	Low	None	Low	Low	None	None	None	None	None	None	None	None	Medium	High	None	Medium	Low
Bridge	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Low	None
Mobility[+]	Low	Low	Low	Low	Low	Low	Low	Low	High	Low	Low	Low	Low	Low	Low	High	Low
Safety[+]	High	Low	High	High	Medium	High	N/A[#]	Low	N/A	Low	N/A	High	N/A	N/A	High	N/A	N/A
Freight[+]	Low	Low	High	High	High	High	Low	High	High	High	High	High	High	N/A	N/A	Medium	High
Average Need	**1.31**	**0.69**	**1.77**	**1.77**	**1.38**	**1.62**	**0.60**	**1.15**	**1.80**	**1.15**	**1.20**	**1.62**	**1.60**	**1.29**	**1.20**	**2.10**	**1.40**

** A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

[+] *Identified as an emphasis area for the SR 87/SR 260/SR 377 corridor.*

 # N/A indicates insufficient or no data available to determine level of need

^ Segment 40B-17 Pavement Need estimated based on field review

Average Need Scale	
None*	< 0.1
Low	0.1 - 1.0
Medium	1.0 - 2.0
High	> 2.0

Summary of Corridor

The needs in each performance area are shown in **Figure 21** and summarized below:

Pavement Needs

- Seven segments (87-1, 87-3, 87-4, 260-12, 260-13, 277-14, and 77-16) contain Pavement hot spots, but one of these segments had recent paving projects that addressed the need
- Segments 87-1, 87-3, 87-4, and 40B-17 have final needs of Low and Segments 260-13 and 77-16 have final needs of Medium. Segment 277-14 was the only High need segment along the corridor; all other segments on the corridor have a final need of None

Bridge Needs

- Seven segments (87-6, 87-7, 260-8, 260-9, 277-14, 377-15, and 40B-17) do not include any bridges
- Segment 77-16 includes one bridge, the Little Colorado River Bridge, which is functionally obsolete
- There are no final Bridge needs along the corridor

Mobility Needs

- Low Mobility needs exist on fifteen of the seventeen segments of the corridor.
- Two segments (260-9 and 77-16) have High final needs
- Segment 260-9 has high existing, directional, and future V/C needs
- Many segments contain Medium or High directional PTI needs
- Bicycle accommodation needs are High on ten of the seventeen segments of the corridor

Safety Needs

- High Safety needs exist on six of the seventeen segments of the corridor
- Safety hot spots exist in Segments 87-4, 87-6, and 260-8
- Many of the segments of the corridor (87-7, 260-9, 260-11, 260-13, 277-14, 77-16, 40B-17) contain insufficient data to determine levels of need, so a need value is not available (N/A)

Freight Needs

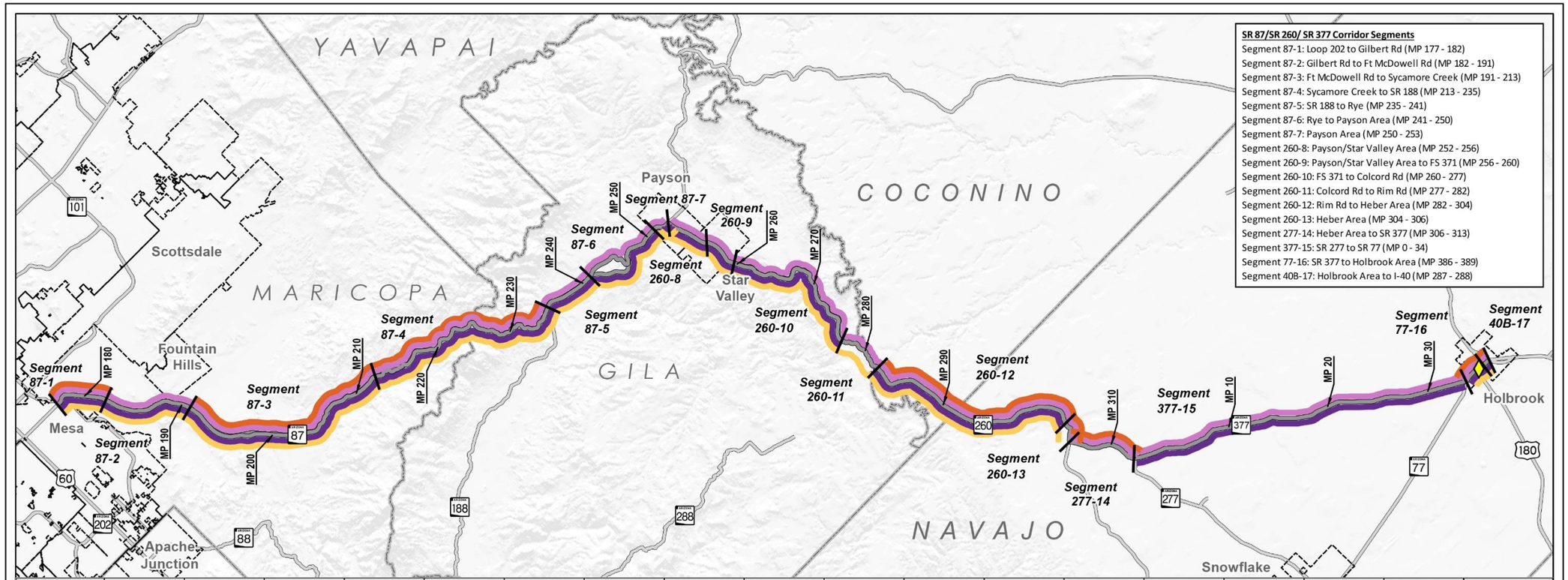
- High Freight needs exist on eleven of the seventeen segments
- Many segments along the corridor contain High directional PTI and closure duration needs
- No freight hotspots exist along the corridor
- Segments 277-14 and 377-15 have no data to determine a level of need

Overlapping Needs

This section identifies overlapping performance needs on the SR 87/SR 260/SR 377 corridor, which provides guidance to develop strategic solutions that address more than one performance area with elevated levels of need. Completing projects that address multiple needs presents the opportunity to more effectively improve overall performance. A summary of the overlapping needs that relate to locations with elevated levels of need is provided below.

- Segments 87-3, 87-4, 87-5, 87-6 and 260-12 all contain elevated Needs in the Safety and Freight performance areas
- Segment 77-16, which has the highest average need score of all the segments of the corridor, has elevated needs in Pavement, Mobility, and Freight
- Segment 260-9 contains elevated Needs in the Mobility and Freight performance areas

Figure 21 Corridor Needs Summary



SR 87/SR 260/ SR 377 Corridor Segments

Segment 87-1: Loop 202 to Gilbert Rd (MP 177 - 182)
Segment 87-2: Gilbert Rd to Ft McDowell Rd (MP 182 - 191)
Segment 87-3: Ft McDowell Rd to Sycamore Creek (MP 191 - 213)
Segment 87-4: Sycamore Creek to SR 188 (MP 213 - 235)
Segment 87-5: SR 188 to Rye (MP 235 - 241)
Segment 87-6: Rye to Payson Area (MP 241 - 250)
Segment 87-7: Payson Area (MP 250 - 253)
Segment 260-8: Payson/Star Valley Area (MP 252 - 256)
Segment 260-9: Payson/Star Valley Area to FS 371 (MP 256 - 260)
Segment 260-10: FS 371 to Colcord Rd (MP 260 - 277)
Segment 260-11: Colcord Rd to Rim Rd (MP 277 - 282)
Segment 260-12: Rim Rd to Heber Area (MP 282 - 304)
Segment 260-13: Heber Area (MP 304 - 306)
Segment 277-14: Heber Area to SR 377 (MP 306 - 313)
Segment 377-15: SR 277 to SR 77 (MP 0 - 34)
Segment 77-16: SR 377 to Holbrook Area (MP 386 - 389)
Segment 40B-17: Holbrook Area to I-40 (MP 287 - 288)

Performance Area	87-1	87-2	87-3	87-4	87-5	87-6	87-7	260-8	260-9	260-10	260-11	260-12	260-13	277-14	377-15	77-16	40B-17^	Performance Area
	MP 177-182	MP 182-191	MP 191-213	MP 213-235	MP 235-241	MP 241-250	MP 250-253	MP 252-256	MP 256-260	MP 260-277	MP 277-282	MP 282-304	MP 304-306	MP 306-313	MP 0-34	MP 386-389	MP 287-288	
Pavement	Low	None	Low	Low	None	None	None	None	None	None	None	None	Medium	High	None	Medium	Low	Pavement
Bridge	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Low	None	Bridge
Mobility*	Low	Low	Low	Low	Low	Low	Low	Low	High	Low	Low	Low	Low	Low	Low	High	Low	Mobility*
Safety*	High	Low	High	High	Medium	High	N/A#	Low	N/A	Low	N/A	High	N/A	N/A	High	N/A	N/A	Safety*
Freight*	Low	Low	High	High	High	High	Low	High	High	High	High	High	High	N/A	N/A	Medium	High	Freight*
Average Need (0-3)	1.31	0.69	1.77	1.77	1.38	1.62	0.60	1.15	1.80	1.15	1.20	1.62	1.60	1.29	1.20	2.10	1.40	Average Need (0-3)

* Identified as emphasis areas for SR 87/SR 260/SR 377 corridor
^ 40B-17 Pavement Need estimated based on field review
# N/A indicates insufficient or no data available to determine level of need
+ A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study

Miles
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Corridor Segment
County Boundary
Interstate/Highway
City Boundary

Performance Area Needs
Pavement
Mobility
Safety
Freight
Bridge

Level of Need	Average Need
None+	< 0.1
Low	0.1 - 1.0
Medium	1.0 - 2.0
High	> 2.0

SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Needs Summary

4.0 STRATEGIC SOLUTIONS

The principal objective of the CPS is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State's key transportation corridors. One of the first steps in the development of strategic solutions is to identify areas of elevated levels of need (i.e., Medium or High). Addressing areas of Medium or High need will have the greatest effect on corridor performance and are the focus of the strategic solutions. Segments with Medium or High needs and specific locations of hot spots are considered strategic investment areas for which strategic solutions should be developed. Segments with lower levels of need or without identified hot spots are not considered candidates for strategic investment and are expected to be addressed through other ADOT programming processes. The SR 87/SR 260/SR 377 strategic investment areas (resulting from the elevated needs) are shown in **Figure 22**.

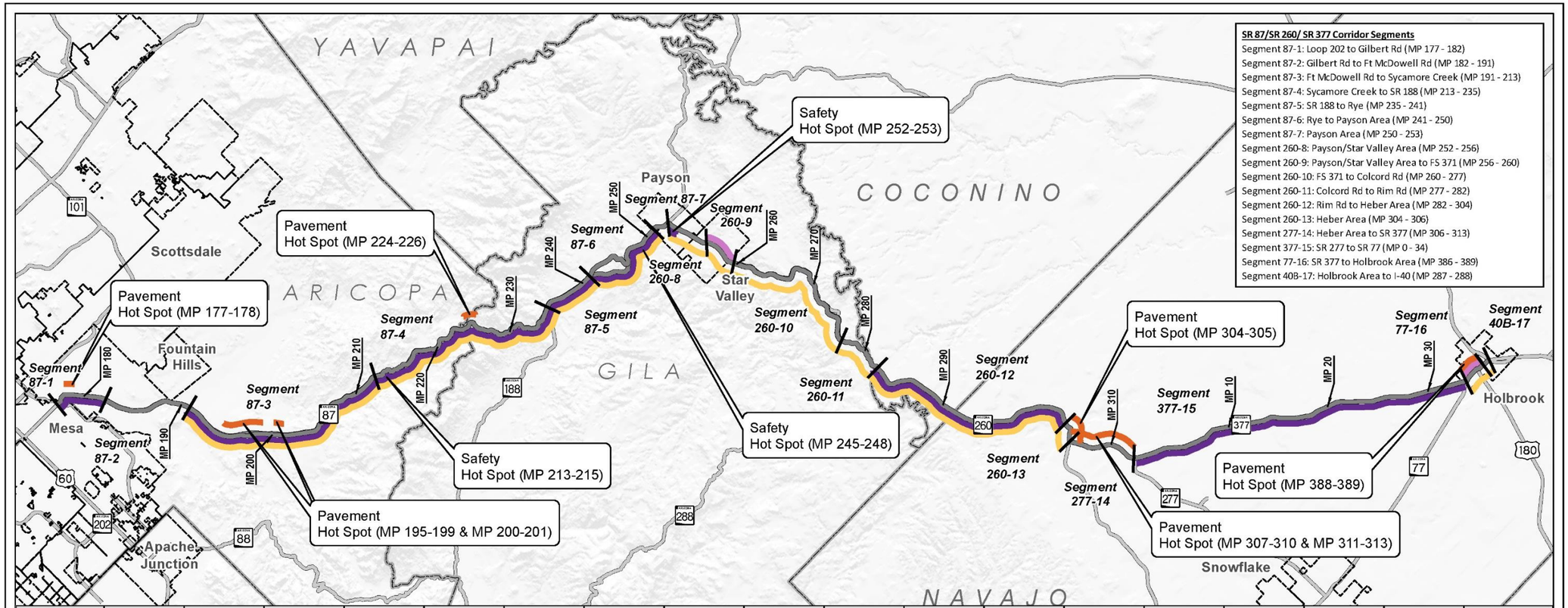
4.1 Screening Process

This section examines qualifying strategic needs and determines if the needs in those locations require action. In some cases, needs that are identified do not advance to solutions development and are screened out from further consideration because they have been or will be addressed through other measures, including:

- A project is programmed to address this need
- The need is a result of a Pavement or Bridge hot spot that does not show historical investment or rating issues; these hot spots will likely be addressed through other ADOT programming means
- A bridge is not a hot spot but is located within a segment with a Medium or High level of need; this bridge will likely be addressed through current ADOT bridge maintenance and preservation programming processes
- The need is determined to be non-actionable (i.e., cannot be addressed through an ADOT project)
- The conditions/characteristics of the location have changed since the performance data was collected that was used to identify the need

Table 18 notes if each potential strategic need advanced to solution development, and if not, the reason for screening the potential strategic need out of the process. Locations advancing to solutions development are marked with Yes (Y); locations not advancing are marked with No (N) and highlighted. This screening table provides specific information about the needs in each segment that will be considered for strategic investment. The table identifies the level of need – either Medium or High segment needs, or segments without Medium or High level of need that have a hot spot. Each area of need is assigned a location number in the screening table to help document and track locations considered for strategic investment.

Figure 22: Strategic Investment Areas



Performance Area	87-1	87-2	87-3	87-4	87-5	87-6	87-7	260-8	260-9	260-10	260-11	260-12	260-13	277-14	377-15	77-16	40B-17^	Performance Area
	MP 177-182	MP 182-191	MP 191-213	MP 213-235	MP 235-241	MP 241-250	MP 250-253	MP 252-256	MP 256-260	MP 260-277	MP 277-282	MP 282-304	MP 304-306	MP 306-313	MP 0-34	MP 386-389	MP 287-288	
Pavement	Hot Spot	-	Hot Spot	Hot Spot	-	-	-	-	-	-	-	-	Medium	High	-	Medium	-	Pavement
Bridge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Bridge
Mobility*	-	-	-	-	-	-	-	-	High	-	-	-	-	-	-	High	-	Mobility*
Safety*	High	-	High	High	Medium	High	N/A#	Hot Spot	N/A	-	N/A	High	N/A	N/A	High	N/A	N/A	Safety*
Freight*	-	-	High	High	High	High	-	High	High	High	High	High	High	N/A	N/A	Medium	High	Freight*

* Identified as emphasis area for SR 87/SR 260/SR 377 Corridor

^40B-17 Pavement Need estimated bases on field review

N/A indicate insufficient or no data available to determine level of need

Note: Figure shows strategic investment areas, which are segments with Medium and High levels of need and locations of hot spots. A "-" symbol indicates a segment level of need of Low or None, which is not considered strategic

SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Strategic Investment Areas

Miles
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Performance Area Needs

- Corridor Segment
- County Boundary
- Interstate/Highway
- City Boundary
- Pavement
- Mobility
- Safety
- Freight
- Bridge

Level of Need
Low
Medium
High

Table 18: Strategic Investment Area Screening

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
87-1 (MP 177-182)	Hot Spot			High		L1	Safety	MP 177-182 has a Safety Index significantly above the statewide average, particularly in the NB direction; secondary performance scores are average or better Crash data analysis indicates % of crashes above statewide average related to collisions with pedestrians and fixed objects, 29% failure to yield, 58% in dark conditions, and 29% under the influence; 6 fatal crashes	Y	No programmed project to address Safety need
						L2	Pavement	Hot spot NB at MP 177-178	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes
87-2 (MP 182-191)						No Strategic Needs Identified				
87-3 (MP 191-213)	Hot Spot			High	High	L3	Safety	MP 191-213 has a High level of need based on the Safety Index in the SB direction and motorcycle crashes Crash data analysis indicates % of crashes above statewide average related to overturning and other non-collision crashes, 72% involve single vehicle, 50% run off road (left or right), and 11% sideswipe in same direction; 7 fatal crashes and 7 involving motorcycles	Y	No programmed project to address Safety need
						L4	Freight	MP 191-213 has a High level of need based on the overall Freight Index, SB directional PTI scores, closure duration in the NB direction	Y	No programmed project to address Freight need
						L5	Pavement	Hot spot SB at MP 195-199 and 200-201	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes
87-4 (MP 213-235)	Hot Spot			High	High	L6	Safety	MP 213-235 has a High level of need based on the Safety Index and motorcycle-related crashes Crash data analysis indicates percent of crashes above statewide average related to collision with fixed object and other non-collision crashes, 80% involve single vehicle, 53% speed too fast for conditions, and 80% run off road (left or right), and 80% single vehicle; 9 fatal crashes, 21 incapacitating injury crashes, and 15 crashes involving motorcycles	Y	No programmed project to address Safety need

Legend: Strategic investment area screened out from further consideration

Table 18: Strategic Investment Area Screening (continued)

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
87-4 (MP 213-235)	Hot Spot			High	High	L7	Safety	Hot spot NB at MP 213-215	Y	No programmed project to address Safety need
						L8	Freight	MP 213-215 has a High level of need based on the overall Freight Index, NB directional (TTI), and both directional PTI scores, and closure duration in the NB direction	Y	No programmed project to address Freight need
						L9	Pavement	Hot spot NB/SB at MP 224-226	Y	No programmed project to address Pavement need; high historical investment
87-5 (MP 235-241)				Medium	High	L10	Freight	MP 235-241 has a High level of need based on the overall Freight Index, SB directional PTI scores	Y	No programmed project to address Freight need
						L11	Safety	MP 235-241 has a High level of need based on the SB directional Safety Index	Y	No programmed project to address Safety need
87-6 (MP 241-250)				High	High	L12	Freight	MP 241-250 has a High level of need based on the overall Freight Index, NB directional TTI, both directional PTI scores, and closure duration in the SB direction	Y	No programmed project to address Freight need
						L13	Safety	MP 241-250 has a High level of need based on the SB directional Safety Index and high rate of fatal and incapacitating injury crashes involving Strategic Highway Safety Plan (SHSP) Top 5 Emphasis Areas Crash data analysis indicates % of crashes above statewide average related to collision with fixed object, overturning, and other non-collision crashes, 86% involve single vehicle, 21% inattention, and 93% run off road (left or right) or crossed centerline, and 50% under the influence; 6 fatal crashes, 8 incapacitating injury crashes, and 2 involving motorcycles	Y	No programmed project to address Safety need
						L14	Safety	Hot spot SB at MP 245-248	Y	No programmed project to address Safety need
87-7 (MP 250-253)				N/A		No Strategic Needs Identified				

Legend: Strategic investment area screened out from further consideration

Table 18: Strategic Investment Area Screening (continued)

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
260-8 (MP 252-256)				Hot spot	High	L15	Freight	High level of need based on the overall Freight Index and EB directional PTI scores	Y	No programmed project to address Freight need
						L16	Safety	Hot spot EB at MP 252-253	Y	No programmed project to address Safety need
260-9 (MP 256-260)			High	N/A	High	L17	Mobility	MP 256-260 has a High level of need based on the existing and future V/C performance; this segment also exhibits poor performance in the EB directional PTI and poor bicycle accommodation; this segment has a percentage of weather-related closures greater than the statewide average	Y	No programmed project to address mobility need in first three years of five-year program, but reconstruction of segment to a 4-lane divided highway facility is programmed for design in FY 2021 with tentative construction in FY 2024
						L18	Freight	MP 256-260 has a High level of need based on the overall Freight Index, EB directional PTI scores, and closure duration in the WB direction	Y	No programmed project to address Freight need
260-10 (MP 260-277)					High	L19	Freight	MP 260-277 has a High level of need based on the overall Freight Index, both directional PTI scores, and closure duration in both directions	Y	No programmed project to address Freight need
260-11 (MP 277-282)				N/A	High	L20	Freight	MP 277-282 has a High level of need based on the overall Freight Index, EB directional TTI and PTI scores, and closure duration in both directions	Y	No programmed project to address Freight need
260-12 (MP 282-304)				High	High	L21	Safety	MP 282-304 has a High level of need based on the EB directional Safety Index with significant directional split	Y	No programmed project to address Safety need
						L22	Freight	MP 282-304 has a Medium level of need based on the overall Freight Index, WB directional PTI, and closure duration in the WB direction	Y	No programmed project to address Freight need
260-13 (MP 304-306)	Medium			N/A	High	L23	Freight	MP 304-306 has a High level of need based on the overall Freight Index, WB directional TTTI, both directional TPTI scores, and closure duration in the WB direction	N	Freight needs considered non-actionable because high TTTI and TPTI scores are likely a result of travel times being skewed due to vehicles parking at businesses adjacent to the roadway

Legend: Strategic investment area screened out from further consideration

Table 18: Strategic Investment Area Screening (continued)

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
260-13 (MP 304-306)	Medium			N/A	High	L24	Pavement	MP 304-306 has 50% Area Failure	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes
						L25	Pavement	Hot spot EB at MP 304-305	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes
277-14 (MP 306-313)	High			N/A	N/A	L26	Pavement	MP 306-313 has a High level of need based on the Pavement Index with over 71% Area Failure	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes
						L27	Pavement	Hot spot NB at MP 307-310 and 311-313	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes
377-15 (MP 0-34)				High	N/A	L28	Safety	MP 0-34 has a High level of need based on the Safety Index in both directions and high rate of fatal and incapacitating injury crashes involving SHSP Top 5 Emphasis Areas Crash data analysis indicates % of crashes above statewide average including 73% for each overturning and involve single vehicle, 36% under the influence, 27% for each failure to keep in proper lane, and speed too fast for conditions, 64% ran off road (right), and 18% for sideswipe; 4 fatal crashes, 7 incapacitating injury crashes, and 3 involving trucks	N	Programmed project in FY 2018 to reconstruct horizontal curves and widen shoulders to 8 feet in both directions (10 locations, MP 3-34)
77-16 (MP 386-389)	Medium		High	N/A	Medium	L29	Mobility	MP 386-389 has a High level of need based on the future V/C and bicycle accommodation; the segment also has an at-grade railroad crossing	Y	No programmed project to address Mobility need
						L30	Freight	MP 386-389 has a Medium level of need based on the overall Freight Index	Y	No programmed project to address Freight need
						L31	Pavement	MP 386-389 has a Medium level need based on the Pavement Index and % Area Failure	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes.
						L32	Pavement	Hot spot NB at MP 388-389	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes.

Legend: Strategic investment area screened out from further consideration

Table 18: Strategic Investment Area Screening (continued)

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
40B-17 (MP 287-288)				N/A	High	L33	Freight	MP 287-288 has a High level of need based on the overall Freight Index and NB/SB directional TTTI and TPTI scores	N	Need will be partially addressed through the solutions developed for Segment 77-16; remaining need considered non-actionable because high TTTI and TPTI scores are likely a result of travel times being skewed due to vehicles parking at businesses adjacent to the roadway

Legend: Strategic investment area screened out from further consideration

4.2 Candidate Solutions

For each elevated need within a strategic investment area that is not screened out, a candidate solution is developed to address the identified need. Each candidate solution is assigned to one of the following three P2P investment categories based on the scope of the solution:

- Preservation
- Modernization
- Expansion

Documented performance needs serve as the foundation for developing candidate solutions for corridor preservation, modernization, and expansion. Candidate solutions are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT's traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the SR 87/SR 260/SR 377 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

Characteristics of Strategic Solutions

Candidate solutions should include some or all of the following characteristics:

- Do not recreate or replace results from normal programming processes
- May include programs or initiatives, areas for further study, and infrastructure projects
- Address elevated levels of need (High or Medium) and hot spots
- Focus on investments in modernization projects (to optimize current infrastructure)
- Address overlapping needs
- Reduce costly repetitive maintenance
- Extend operational life of system and delay expansion
- Leverage programmed projects that can be expanded to address other strategic elements
- Provide measurable benefit

Candidate Solutions

A set of 16 candidate solutions are proposed to address the identified needs on the SR 87/SR 260/SR 377 corridor.

Table 19 identifies each strategic location that has been assigned a candidate solution, with a number (e.g., CS87.1, CS87.2, etc.). Each candidate solution is comprised of one or more components to address the identified needs. The assigned candidate solution numbers are linked to the location number and provide tracking capability through the rest of the process. The locations of proposed solutions are shown on the map in **Figure 23**.

Candidate solutions developed to address an elevated need in the Pavement or Bridge performance area will include two options: rehabilitation or full replacement. These solutions are initially evaluated through a Life-Cycle Cost Analysis (LCCA) to provide insights into the cost-effectiveness of these options so a recommended approach can be identified. Candidate solutions developed to address an elevated need in the Mobility, Safety, or Freight performance areas are advanced directly to the Performance Effectiveness Evaluation. In some cases, there may be multiple solutions identified to address the same area of need.

Candidate solutions that are recommended to expand or modify the scope of an already programmed project are noted and are not advanced to solution evaluation and prioritization. These solutions are directly recommended for programming.

Table 19: Candidate Solutions

Candidate Solution #	Segment #	Location #	Beginning Milepost	Ending Milepost	Candidate Solution Name	Option*	Scope	Investment Category (Preservation [P], Modernization [M], Expansion [E])
CS87.1	87-1	L1	177	182	Salt River Area Safety Improvements	-	-Install warning signs and chevrons on curved Salt River bridge approaches -Install raised pavement markers along the outside edge line -Install lighting at Oak St (MP 178.4), Center St (MP 179.1), Mesa Dr (MP 179.7), and Camelback Rd (MP 181.0) -Install raised concrete barrier in median on Salt River bridge and approaches (MP 177.0-177.5)	M
CS87.2	87-3	L3/L4	191	213	Bush Highway Area Safety and Freight Improvements	-	-Rehabilitate shoulders (NB/SB MP 194-205) -Install speed feedback signs (NB MP 206.5 and 207.7, NB/SB before curves and intersection with FR 68 [MP 209.6]) -Widen inside shoulders (SB MP 211-209)	M
CS87.3	87-4	L6/L7	213	235	Sunflower Area Safety Improvements	-	-Install speed feedback signs and speed advisory warning signs with flashing beacons at curves (NB MP 213.2, 214.0, 217.8, 220.5, 224.5, 232.5; SB MP 231.0, 229.3, 221.0, 219.6, 216.0, 214.3) -Rehabilitate shoulders -Widen inside shoulders (SB MP 228.5-226.0) -Install rock-fall mitigation (NB MP 214.2-214.6; SB MP 228.9-228.7, 228.5-228.0, 217.6-218.0)	M
CS87.4	87-4	L8	213	223	Sunflower Area Freight Improvements	-	-Construct NB climbing lane, MP 213-215 and MP 219-223 -Widen Whiskey Springs Bridge, #2515 MP 220.32 -Widen Upper Kitty Joe Bridge, #2497 MP 221.39	M
CS87.5	87-4	L9	224	226	Slate Creek Pavement Improvements	A	-Rehabilitate pavement	P
						B	-Replace pavement	M
CS87.6	87-5	L10/L11	235	241	Rye Area Safety and Freight Improvements	-	-Install advisory sign about approaching area with intersections (Deer Creek Drive [MP 237.6], Gisela Road [MP 239.5], two intersections in Rye [MP 240.5 and MP 240.9]) -Install reduced speed advisory sign on SR 87 (NB MP 240, SB MP 241) -Install speed feedback signs (NB MP 240, SB MP 241) -On SR 188 approaching SR 87 add flashing beacons to WB stop sign	M
CS87.7	87-6	L13	241	250	Ox Bow Estates Area Safety Improvements	-	-Install speed feedback signs and speed advisory warning signs with flashing beacons at curves (SB MP 247, MP 245) -Implement variable speed limits MP 241-246 with new DMS and CCTV SB at MP 247 and new DMS and CCTV NB at MP 240 -Install RWIS at MP 245 with dynamic weather warning beacons	M
CS87.8	87-6	L12	243	247	Ox Bow Estates Area Freight Improvements	-	-Construct NB climbing lane	M
CS87.9	87-6	L14	246	251	Mazatzal Area Safety Improvements	-	-Widen shoulders SB MP 246.2-250.9	M

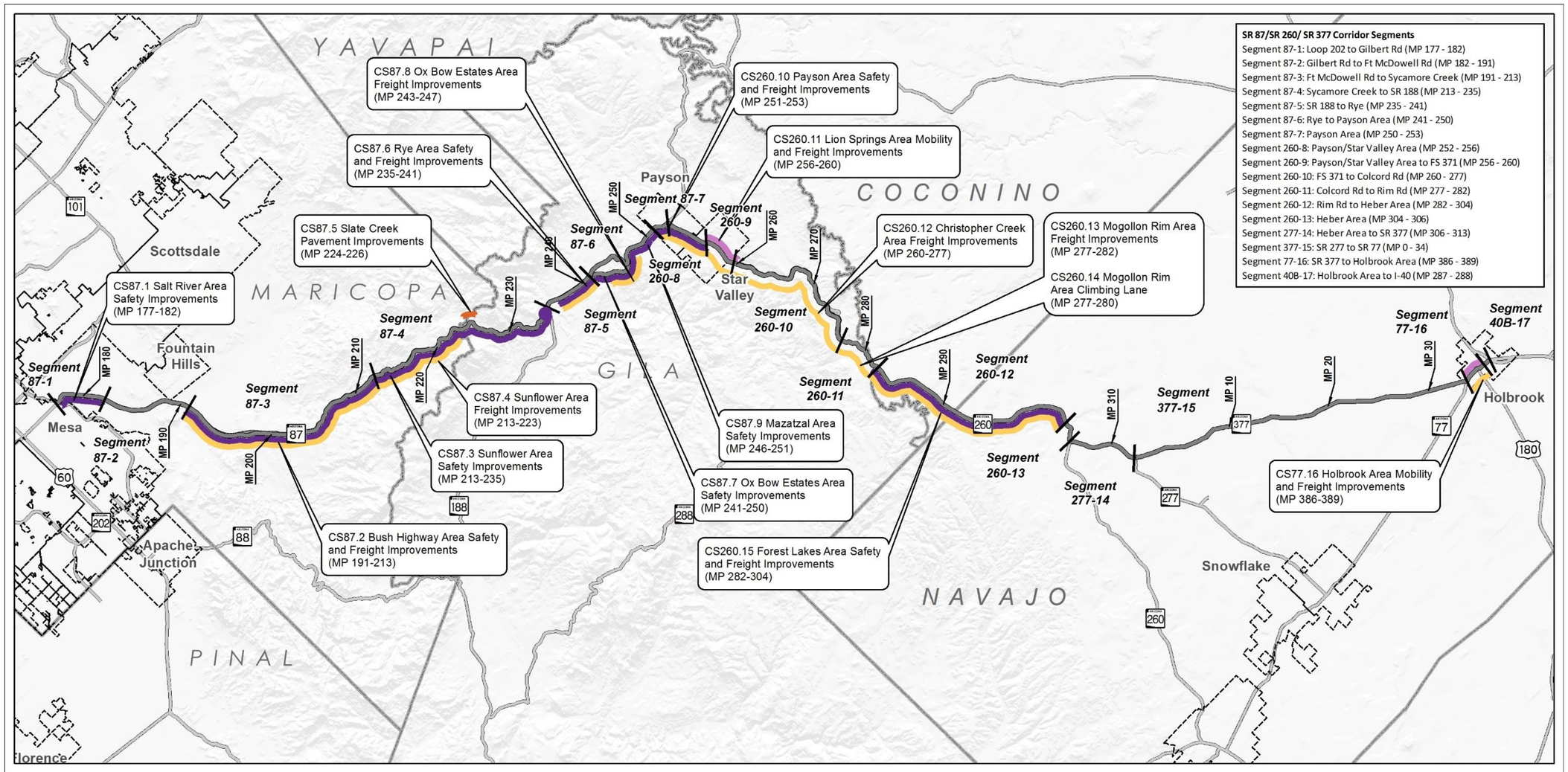
* '-' indicates only one solution is being proposed and no options are being considered

Table 19: Candidate Solutions (continued)

Candidate Solution #	Segment #	Location #	Beginning Milepost	Ending Milepost	Candidate Solution Name	Option*	Scope	Investment Category (Preservation [P], Modernization [M], Expansion [E])
CS260.10	87-7 & 260-8	L15/L16	251 (SR 87)	253 (SR 260)	Payson Area Safety and Freight Improvements	A	-Implement signal coordination/adaptive control for six signals in Payson urban area (SR 87/SR 260 intersection, SR 260/Payson Village Center, SR 260/Manzanita Dr, SR 87/Main St, SR 87/Bonita St, and SR 87/Green Valley Parkway [BIA 101]) -Implement protected/permitted left-turn phasing at SR 87/Manzanita Dr intersection (NB and SB approaches) and provide advance signal advisory sign with flashing beacons WB on SR 260	M
						B	-Reconstruct three signalized intersections as double-lane roundabouts (SR 87/Bonita St, SR 87/SR 260 intersection, and SR 260/Manzanita Dr) -Implement signal coordination/adaptive control for three signals in Payson urban area (SR 87/Green Valley Parkway [BIA 101], SR 87/Main St, and SR 260/Payson Village Center)	M
CS260.11	260-9	L17/L18	256	260	Lion Springs Area Mobility and Freight Improvements	-	-Reconstruct to 4-lane divided highway (using the existing 2-lane road for one direction)	E
CS260.12	260-10	L19	260	277	Christopher Creek Area Freight Improvements	-	-Install rock-fall mitigation (WB MP 262.2-262.6, 261.6-261.9, 269.0-269.1, 269.7-269.8, 271.3-271.5; EB MP 269.8-269.9, 272.6-272.7) -Implement variable speed limits at MP 272-277 and new DMS and CCTV at MP 272 EB	M
CS260.13	260-11	L20	277	282	Mogollon Rim Area Freight Improvements	-	-Install centerline rumble strips -Install rock-fall mitigation (WB MP 278.4-278.6, 279.8-280.9, 281.4-282.0) -Install RWIS at MP 282 with dynamic weather warning beacons -Implement variable speed limits at MP 277-282 and new DMS and CCTV at MP 282 WB	M
CS260.14	260-11	L20	277	280	Mogollon Rim Area Climbing Lane	-	-Construct EB climbing lane	M
CS260.15	260-12	L21/L22	282	304	Forest Lakes Area Safety and Freight Improvements	-	-Widen shoulders -Construct alternating passing lanes (varying locations for 11 miles of the segment)	M
CS77.16	77-16	L29/L30	386	389	Holbrook Area Mobility and Freight Improvements	A	-Construct new roadway connection between SR 377/SR 77 and I-40/40B West TI (Exit 285) west of Holbrook; includes new bridge over the Little Colorado River and overpass at railroad crossing	E
						B	-Construct new roadway connection between US 180/SR 77 and I-40/40B West TI (Exit 285) west of Holbrook; includes new bridge over the Little Colorado River and overpass at railroad crossing	E
						C	-Construct overpass at at-grade railroad crossing and new bridge over the Little Colorado River adjacent to existing SR 77 alignment -Remove existing Little Colorado River Bridge	E

* '-' indicates only one solution is being proposed and no options are being considered

Figure 23: Candidate Solutions



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Candidate Solutions

5.0 SOLUTION EVALUATION AND PRIORITIZATION

Candidate solutions are evaluated using the following steps: LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation are shown in **Figure 24** and described more fully below.

Life-Cycle Cost Analysis

All Pavement and Bridge candidate solutions have two options: rehabilitation/repair or reconstruction. These options are evaluated through an LCCA to determine the best approach for each location where a Pavement or Bridge solution is recommended. The LCCA can eliminate options from further consideration and identify which options should be carried forward for further evaluation.

When multiple independent candidate solutions are developed for Mobility, Safety, or Freight strategic investment areas, these candidate solution options advance directly to the Performance Effectiveness Evaluation without an LCCA.

Performance Effectiveness Evaluation

After completing the LCCA process, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Analysis to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

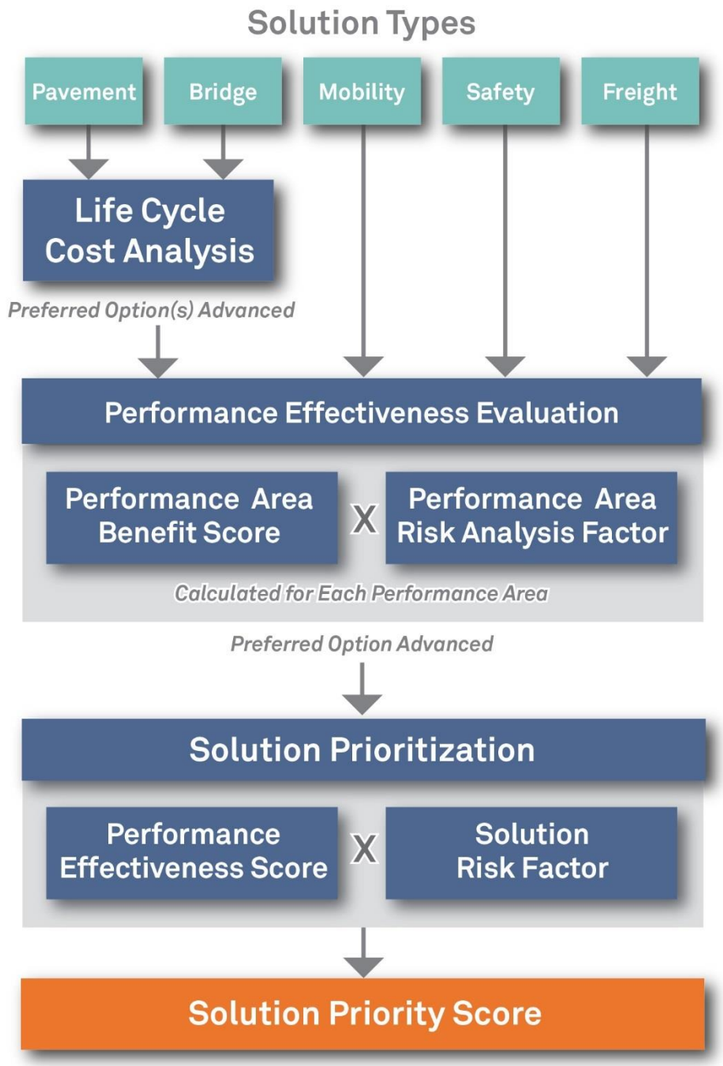
Solution Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Solution Risk Analysis process. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of performance failure.

Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score. The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

Figure 24: Candidate Solution Evaluation Process



5.1 Life-Cycle Cost Analysis

LCCA is conducted for any candidate solution that is developed as a result of a need in the Pavement or Bridge performance area. The intent of the LCCA is to determine which options warrant further investigation and eliminate options that would not be considered strategic.

LCCA is an economic analysis that compares cost streams over time and presents the results in a common measure, the present value of all future costs. The cost stream occurs over an analysis period that is long enough to provide a reasonably fair comparison among alternatives that may differ significantly in scale of improvement actions over shorter time periods. For both bridge and pavement LCCA, the costs are focused on agency (ADOT) costs for corrective actions to meet the objective of keeping the bridge or pavement serviceable over a long period of time.

LCCA is performed to provide a more complete holistic perspective on asset performance and agency costs over the life of an investment stream. This approach helps ADOT look beyond initial and short-term costs, which often dominate the considerations in transportation investment decision making and programming.

Bridge LCCA

For the bridge LCCA, three basic strategies are analyzed that differ in timing and scale of improvement actions to maintain the selected bridges, as described below:

- Bridge replacement (large upfront cost but small ongoing costs afterwards)
- Bridge rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- On-going repairs until replacement (low upfront and ongoing costs until replacement)

The bridge LCCA model developed for the CPS reviews the characteristics of the candidate bridges including bridge ratings and deterioration rates to develop the three improvement strategies (full replacement, rehabilitation until replacement, and repair until replacement). Each strategy consists of a set of corrective actions that contribute to keeping the bridge serviceable over the analysis period. Cost and effect of these improvement actions on the bridge condition are essential parts of the model. Other considerations in the model include bridge age, elevation, pier height, length-to-span ratio, skew angle, and substandard characteristics such as shoulders and vehicle clearance. The following assumptions are included in the bridge LCCA model:

- The bridge LCCA only addresses the structural condition of the bridge and does not address other issues or costs
- The bridge will require replacement at the end of its 75-year service life regardless of current condition
- The bridge elevation, pier height, skew angle, and length-to-span ratio can affect the replacement and rehabilitation costs
- The current and historical ratings are used to estimate a rate of deterioration for each candidate bridge
- Following bridge replacement, repairs will be needed every 20 years
- Different bridge repair and rehabilitation strategies have different costs, expected service life, and benefit to the bridge rating
- The net present value of future costs is discounted at 3% and all dollar amounts are in 2015 dollars
- If the LCCA evaluation recommends rehabilitation or repair, the solution is not considered strategic and the rehabilitation or repair will be addressed by normal programming processes
- Because this LCCA is conducted at a planning level, and due to the variabilities in costs and improvement strategies, the LCCA net present value results that are within 15% should be considered equally; in such a case, the solution should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed

Based on the candidate solutions presented in **Table 19**, LCCA was not conducted for any bridges on the SR 87/SR 260/SR 377 corridor, as noted in **Table 20**.

Pavement LCCA

The LCCA approach to pavement is very similar to the process used for bridges. For the pavement LCCA, three basic strategies are analyzed that differ in timing and scale of improvement actions to maintain the selected pavement, as described below:

- Pavement replacement (large upfront cost but small ongoing costs afterwards – could be replacement with asphalt or concrete pavement)
- Pavement major rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- Pavement minor rehabilitation until replacement (low upfront and ongoing costs until replacement)

The pavement LCCA model developed for the CPS reviews the characteristics of the candidate paving locations including the historical rehabilitation frequency to develop potential improvement strategies (full replacement, major rehabilitation until replacement, and minor rehabilitation until replacement, for either concrete or asphalt, as applicable). Each strategy consists of a set of corrective actions that contribute to keeping the pavement serviceable over the analysis period. The following assumptions are included in the pavement LCCA model:

- The pavement LCCA only addresses the condition of the pavement and does not address other issues or costs
- The historical pavement rehabilitation frequencies at each location are used to estimate future rehabilitation frequencies
- Different pavement replacement and rehabilitation strategies have different costs and expected service life

- The net present value of future costs is discounted at 3% and all dollar amounts are in 2015 dollars
- If the LCCA evaluation recommends rehabilitation or repair, the solution is not considered strategic and the rehabilitation will be addressed by normal programming processes
- Because this LCCA is conducted at a planning level, and due to the variabilities in costs and improvement strategies, the LCCA net present value results that are within 15% should be considered equally; in such a case, the solution should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed

Based on the candidate solutions presented in **Table 19**, LCCA was conducted for one pavement section on the SR 87/SR 260/SR 377 corridor. A summary of this analysis is shown in **Table 21**. Additional information regarding the pavement LCCA is included in **Appendix E**.

As shown in **Table 20** and **Table 21**, the following conclusions were determined based on the LCCA:

- Reconstruction was determined to be the most effective approach for the Pavement candidate solution CS87.5; the replace pavement option of this solution was carried forward to the Performance Effectiveness Evaluation

Table 20: Bridge Life-Cycle Cost Analysis Results

Candidate Solution	Present Value at 3% Discount Rate ($)			Ratio of Present Value Compared to Lowest Present Value			Other Needs	Results
	Replace	Rehab	Repair	Replace	Rehab	Repair		
No LCCA conducted for any bridge candidate solution on the SR 87/SR 260/SR 377 corridor								

Table 21: Pavement Life-Cycle Cost Analysis Results

Candidate Solution	Present Value at 3% Discount Rate ($)				Ratio of Present Value Compared to Lowest Present Value				Other Needs	Results
	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehabilitation	Asphalt Light Rehabilitation	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehabilitation	Asphalt Light Rehabilitation		
Slate Creek Pavement Improvements (CS87.5, MP 224-226)	**$9,046,928**	$9,478,848	$9,224,966	$9,478,766	**1.00**	1.05	1.02	1.05	-	Concrete reconstruction is the lowest option and asphalt reconstruction is within 15% of the lowest rehabilitation cost - Replacement is recommended

5.2 Performance Effectiveness Evaluation

The results of the Performance Effectiveness Evaluation are combined with the results of a Performance Area Risk Analysis to determine a Performance Effectiveness Score (PES). The objectives of the Performance Effectiveness Evaluation include:

- Measure the benefit to the performance system versus the cost of the solution
- Include risk factors to help differentiate between similar solutions
- Apply to each performance area that is affected by the candidate solution
- Account for emphasis areas identified for the corridor

The Performance Effectiveness Evaluation includes the following steps:

- Estimate the post-solution performance for each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight)
- Use the post-solution performance scores to calculate a post-solution level of need for each of the five performance areas
- Compare the pre-solution level of need to the post-solution level of need to determine the reduction in level of need (potential solution benefit) for each of the five performance areas
- Calculate performance area risk weighting factors for each of the five performance areas
- Use the reduction in level of need (benefit) and risk weighting factors to calculate the PES

Post-Solution Performance Estimation

For each performance area, a slightly different approach is used to estimate the post-solution performance. This process is based on the following assumptions:

- Pavement:
  - The IRI rating would decrease (to 30 for replacement or 45 for rehabilitation)
  - The Cracking rating would decrease (to 0 for replacement or rehabilitation)
- Bridge:
  - The structural ratings would increase (+1 for repair, +2 for rehabilitation, or increase to 8 for replacement)
  - The Sufficiency Rating would increase (+10 for repair, +20 for rehabilitation, or increase to 98 for replacement)
- Mobility:
  - Additional lanes would increase the capacity and therefore affect the Mobility Index and associated secondary measures
  - Other improvements (e.g., ramp metering, parallel ramps, variable speed limits) would also increase the capacity (to a lesser extent than additional lanes) and therefore would affect the Mobility Index and associated secondary measures
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the TTI secondary measure
  - Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the PTI secondary measure
  - Changes in the Safety Index (due to crash reductions) would have a direct effect on the Closure Extent secondary measure
- Safety:
  - Crash modification factors were developed that would be applied to estimate the reduction in crashes (for additional information see **Appendix F**)
- Freight:
  - Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the Freight Index and the TPTI secondary measure
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the TTTI secondary measure
  - Changes in the Safety Index (due to crash reductions) would have a direct effect on the Closure Duration secondary measure

Performance Area Risk Analysis

The Performance Area Risk Analysis is intended to develop a numeric risk weighting factor for each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight). This risk analysis addresses other considerations for each performance area that are not directly included in the performance system. A risk weighting factor is calculated for each candidate solution based on the specific characteristics at the solution location. For example, the Pavement Risk Factor is based on factors such as the elevation, daily traffic volumes, and amount of truck traffic. Additional information regarding the Performance Area Risk Factors is included in **Appendix G**.

Following the calculation of the reduction in level of need (benefit) and the Performance Area Risk Factors, these values are used to calculate the PES. In addition, the reduction in level of need in each emphasis area is also included in the PES.

Net Present Value Factor

The benefit (reduction in need) is measured as a one-time benefit. However, different types of solutions will have varying service lives during which the benefits will be obtained. For example, a preservation solution would likely have a shorter stream of benefits over time when compared to a modernization or expansion solution. To address the varying lengths of benefit streams, each solution is classified as a 10-year, 20-year, 30-year, or 75-year benefit stream, or the net present value (NPV) factor (F_{NPV}). A 3% discount rate is used to calculate F_{NPV} for each classification of solution. The service lives and respective factors are described below:

- A 10-year service life is generally reflective of preservation solutions such as pavement and bridge preservation; these solutions would likely have a 10-year stream of benefits; for these solutions, a F_{NPV} of 8.8 is used in the PES calculation

- A 20-year service life is generally reflective of modernization solutions that do not include new infrastructure; these solutions would likely have a 20-year stream of benefits; for these solutions, a F_{NPV} of 15.3 is used in the PES calculation
- A 30-year service life is generally reflective of expansion solutions or modernization solutions that include new infrastructure; these solutions would likely have a 30-year stream of benefits; for these solutions, a F_{NPV} of 20.2 is used in the PES calculation
- A 75-year service life is used for bridge replacement solutions; these solutions would likely have a 75-year stream of benefits; for these solutions, a F_{NPV} of 30.6 is used in the PES calculation

Vehicle-Miles Travelled Factor

Another factor in assessing benefits is the number of travelers who would benefit from the implementation of the candidate solution. This factor varies between candidate solutions depending on the length of the solution and the magnitude of daily traffic volumes. Multiplying the solution length by the daily traffic volume results in vehicle-miles travelled (VMT), which provides a measure of the amount of traffic exposure that would receive the benefit of the proposed solution. The VMT is converted to a VMT factor (known as F_{VMT}), which is on a scale between 0 and 5, using the equation below:

$$F_{VMT} = 5 - (5 \times e^{VMT \times -0.0000139})$$

Performance Effectiveness Score

The PES is calculated using the following equation:

PES = ((Sum of all Risk Factored Benefit Scores + Sum of all Risk Factored Emphasis Area Scores) / Cost) x F_{VMT} x F_{NPV}

Where:

Risk Factored Benefit Score = Reduction in Segment-Level Need (benefit) x Performance Area Risk Weighting Factor (calculated for each performance area)

Risk Factored Emphasis Area Score = Reduction in Corridor-Level Need x Performance Area Risk Factors x Emphasis Area Factor (calculated for each emphasis area)

*Cost = estimated cost of candidate solution in millions of dollars (see **Appendix H**)*

F_{VMT} = Factor between 0 and 5 to account for VMT at location of candidate solution based on existing (2014) daily volume and length of solution

F_{NPV} = Factor (ranging from 8.8 to 30.6 as previously described) to address anticipated longevity of service life (and duration of benefits) for each candidate solution

The resulting PES values are shown in **Table 22**. Additional information regarding the calculation of the PES is contained in **Appendix I**.

For candidate solutions with multiple options to address Mobility, Safety, or Freight needs, the PES should be compared to help identify the best performing option. If one option clearly performs better than the other options (e.g., more than twice the PES value and a difference in magnitude of at least 20 points), the other options can be eliminated from further consideration. If multiple options have similar PES values, or there are other factors not accounted for in the performance system that could significantly influence the ultimate selection of an option (e.g., potential environmental concerns, potential adverse economic impacts), those options should all be advanced to the prioritization process. On the SR 87/SR 260/SR 377 corridor, the following candidate solutions have options to address Mobility, Safety, or Freight needs:

- CS260.10 (Options A and B) – Payson Area Safety and Freight Improvements
- CS77.16 (Options A, B, and C) – Holbrook Area Mobility and Freight Improvements

Based on a review of the PES values for solution CS260.10, Option B did not advance to the solution prioritization process because the Option A PES is more than twice that of the Option B PES and the difference is greater than 20 points. Based on a review of the PES values for solution CS77.16, and due to other factors not accounted for in the performance system (environmental concerns and potential economic impacts to the City of Holbrook), all of the CS77.16 options (Options A, B, and C) advanced to the candidate solution prioritization process and received a prioritization score.

As was previously mentioned, pavement reconstruction (Option B) was determined to be the most effective approach for the candidate solution listed below that was subject to LCCA:

- Slate Creek Pavement Improvements (CS87.5, MP 224-226)

Pavement rehabilitation or repair (Option A) for CS87.5 was eliminated from further consideration per the LCCA; no PES value was calculated for Option A of solution CS87.5 and it does not appear in **Table 22**.

Table 22: Performance Effectiveness Scores

Candidate Solution #	Segment #	Option	Candidate Solution Name	Milepost Location	Estimated Cost* (in millions)	Risk Factored Benefit Score					Risk Factored Emphasis Area Scores			Total Factored Benefit Score	F_{VMT}	F_{NPV}	Performance Effectiveness Score
						Pavement	Bridge	Mobility	Safety	Freight	Mobility	Safety	Freight				
CS87.1	87-1	-	Salt River Area Safety Improvements	177-182	$4.7	-	-	0.08	18.38	0.25	0.00	0.81	0.00	19.52	1.43	15.3	91.3
CS87.2	87-3	-	Bush Highway Area Safety and Freight Improvements	191-213	$6.8	-	-	1.85	2.23	3.84	0.00	0.30	0.05	8.26	4.21	15.3	79.7
CS87.3	87-4	-	Sunflower Area Safety Improvements	213-235	$18.3	-	-	2.74	5.71	8.08	0.00	1.04	0.06	17.62	4.78	15.3	70.4
CS87.4	87-4	-	Sunflower Area Freight Improvements	213-219	$43.4	-	-	0.56	1.50	2.01	0.01	0.28	0.01	4.38	1.81	20.2	3.7
CS87.5	87-4	-	Slate Creek Pavement Improvements (Replacement)	224-226	$7.2	0.00	-	0.19	0.63	0.84	0.00	0.12	0.01	1.79	0.70	20.2	3.5
CS87.6	87-5	-	Rye Area Safety and Freight Improvements	235-241	$0.2	-	-	0.73	0.61	0.51	0.00	0.02	0.01	1.89	1.56	8.8	125.7
CS87.7	87-6	-	Ox Bow Estates Area Safety Improvements	241-250	$2.6	-	-	1.03	1.18	0.67	0.01	0.11	0.01	3.01	2.79	15.3	49.3
CS87.8	87-6	-	Ox Bow Estates Area Freight Improvements	243-247	$22.4	-	-	0.55	0.06	0.24	0.01	0.01	0.00	0.87	1.39	20.2	1.1
CS87.9	87-6	-	Mazatzal Area Safety Improvements	246-251	$2.3	-	-	0.96	5.44	0.46	0.00	0.52	0.01	7.39	1.59	15.3	78.9
CS260.10	87-7 and 260-8	A	Payson Area Safety and Freight Improvements (Signals)	251-253	$0.4	-	-	0.12	2.96	0.09	0.00	0.29	0.00	3.44	1.98	8.8	137.3
		B	Payson Area Safety and Freight Improvements (Roundabouts)	251-253	$13.9	-	-	0.67	3.92	1.35	0.00	0.73	0.01	6.66	1.98	20.2	19.2
CS260.11	260-9	-	Lion Springs Area Mobility and Freight Improvements	256-260	$50.0	0.00	-	45.72	7.43	4.63	0.16	0.19	0.03	61.99	2.68	20.2	62.9
CS260.12	260-10	-	Christopher Creek Area Freight Improvements	260-277	$6.5	-	-	0.36	0.33	0.53	0.01	0.05	0.02	1.29	2.09	15.3	6.4
CS260.13	260-11	-	Mogollon Rim Area Freight Improvements	277-282	$8.7	-	-	1.12	0.21	0.95	0.00	0.04	0.01	2.33	1.73	15.3	7.1
CS260.14	260-11	-	Mogollon Rim Area Climbing Lane	277-280	$16.8	-	-	0.46	0.00	0.18	0.00	0.00	0.00	0.64	0.60	20.2	0.5
CS260.15	260-12	-	Forest Lakes Area Safety and Freight Improvements	282-304	$56.5	-	-	7.09	13.21	12.43	0.06	1.78	0.19	34.76	4.19	20.2	52.1
CS77.16	77-16	A	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	386-389	$92.1	3.30	5.30	12.23	11.57	12.09	0.02	0.20	0.22	44.93	1.45	30.6	21.6
		B	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	386-389	$75.8	3.16	5.30	14.43	11.57	12.09	0.04	0.20	0.24	47.03	0.79	30.6	14.9
		C	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)	386-389	$43.8	4.34	5.54	11.33	117.08	12.10	0.01	2.01	0.24	152.65	0.36	30.6	38.4

* See Table 24 for total construction costs

5.3 Solution Risk Analysis

Following the calculation of the PES, an additional step is taken to develop the prioritized list of solutions. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of performance failure. **Figure 25** shows the risk matrix used to develop the risk weighting factors.

Figure 25: Risk Matrix

		Severity/Consequence				
		Insignificant	**Minor**	**Significant**	**Major**	**Catastrophic**
Frequency/ Likelihood	**Very Rare**	Low	Low	Low	Moderate	Major
	Rare	Low	Low	Moderate	Major	Major
	Seldom	Low	Moderate	Moderate	Major	Severe
	Common	Moderate	Moderate	Major	Severe	Severe
	Frequent	Moderate	Major	Severe	Severe	Severe

Using the risk matrix in **Figure 25**, numeric values were assigned to each category of frequency and severity. The higher the risk, the higher the numeric factor that was assigned. The risk weight for each area of the matrix was calculated by multiplying the severity factor times the frequency factor. These numeric factors are shown in **Figure 26**.

Figure 26: Numeric Risk Matrix

			Severity/Consequence				
			Insignificant	**Minor**	**Significant**	**Major**	**Catastrophic**
		Weight	1.00	1.10	1.20	1.30	1.40
Frequency/ Likelihood	**Very Rare**	1.00	1.00	1.10	1.20	1.30	1.40
	Rare	1.10	1.10	1.21	1.32	1.43	1.54
	Seldom	1.20	1.20	1.32	1.44	1.56	1.68
	Common	1.30	1.30	1.43	1.56	1.69	1.82
	Frequent	1.40	1.40	1.54	1.68	1.82	1.96

Using the values in **Figure 26**, risk weighting factors were calculated for each of the following four risk categories: low, moderate, major, and severe. These values are simply the average of the values in **Figure 26** that fall within each category. The resulting average risk weighting factors are:

Low	Moderate	Major	Severe
1.14	1.36	1.51	1.78

The risk weighting factors listed above are assigned to the five performance areas as follows:

- Safety = 1.78
  - The Safety performance area quantifies the likelihood of fatal or incapacitating injury crashes; therefore, it is assigned the Severe (1.78) risk weighting factor
- Bridge = 1.51
  - The Bridge performance area focuses on the structural adequacy of bridges; a bridge failure may result in crashes or traffic being detoured for long periods of time resulting in significant travel time increases; therefore, it is assigned the Major (1.51) risk weighting factor
- Mobility and Freight = 1.36
  - The Mobility and Freight performance areas focus on capacity and congestion; failure in either of these performance areas would result in increased travel times but would not have significant effect on safety (crashes) that would not already be addressed in the Safety performance area; therefore, they are assigned the Moderate (1.36) risk weighing factor
- Pavement = 1.14
  - The Pavement performance area focuses on the ride quality of the pavement; failure in this performance area would likely be a spot location that would not dramatically affect drivers beyond what is already captured in the Safety performance area; therefore, it is assigned the Low (1.14) risk weighting factor

The benefit in each performance area is calculated for each candidate solution as part of the Performance Effectiveness Evaluation. Using this information on benefits and the risk factors listed above, a weighted (based on benefit) solution-level numeric risk factor is calculated for each candidate solution. For example, a solution that has 50% of its benefit in Safety and 50% of its benefit in Mobility has a weighted risk factor of 1.57 (0.50 x 1.36 + 0.50 x 1.78 = 1.57).

5.4 Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score as follows:

Prioritization Score = PES x Weighted Risk Factor x Segment Average Need Score

Where:

*PES = Performance Effectiveness Score as shown in **Table 22***

Weighted Risk Factor = Weighted factor to address risk of not implementing a solution based on the likelihood and severity of the performance failure

*Segment Average Need Score = Segment average need score as shown in **Table 17***

Table 23 shows the prioritization scores for the candidate solutions subjected to the solution evaluation and prioritization process. Solutions that address multiple performance areas tend to score higher in this process. A prioritized list of candidate solutions is provided in the subsequent section. See **Appendix J** for additional information on the prioritization process.

Table 23: Prioritization Scores

Candidate Solution #	Segment #	Option*	Candidate Solution Name	Milepost Location	Estimated Cost (in millions)	Performance Effectiveness Score	Weighted Risk Factor	Segment Average Need Score	Prioritization Score	Percentage by which Solution Reduces Performance Area Segment Needs				
										Pavement	Bridge	Mobility	Safety	Freight
CS87.1	87-1	-	Salt River Area Safety Improvements	177-182	$4.7	91.3	1.77	1.31	**212**	0%	0%	3%	49%	19%
CS87.2	87-3	-	Bush Highway Area Safety and Freight Improvements	191-213	$6.8	79.7	1.49	1.77	**210**	0%	0%	26%	56%	8%
CS87.3	87-4	-	Sunflower Area Safety Improvements	213-235	$18.3	70.4	1.52	1.77	**189**	0%	0%	21%	47%	12%
CS87.4	87-4	-	Sunflower Area Freight Improvements	213-219	$43.4	3.7	1.53	1.77	**10**	0%	0%	5%	11%	3%
CS87.5	87-4	-	Slate Creek Pavement Improvements (Replacement)	224-226	$7.2	3.5	1.54	1.77	**9**	0%	0%	2%	5%	1%
CS87.6	87-5	-	Rye Area Safety and Freight Improvements	235-241	$0.2	125.7	1.50	1.38	**261**	0%	0%	20%	31%	2%
CS87.7	87-6	-	Ox Bow Estates Area Safety Improvements	241-250	$4.1	49.3	1.54	1.62	**123**	0%	0%	8%	5%	2%
CS87.8	87-6	-	Ox Bow Estates Area Freight Improvements	243-247	$22.4	1.1	1.39	1.62	**2**	0%	0%	4%	0%	1%
CS87.9	87-6	-	Mazatzal Area Safety Improvements	246-251	$2.3	78.9	1.70	1.62	**216**	0%	0%	7%	28%	2%
CS260.10	87-7 and 260-8	-	Payson Area Safety and Freight Improvements (Signals)	251-253	$0.4	137.3	1.75	0.71	**171**	0%	0%	1%	18%	1%
CS260.11	260-9	-	Lion Springs Area Mobility and Freight Improvements	256-260	$50.0	62.9	1.41	1.80	**160**	0%	0%	83%	41%	11%
CS260.12	260-10	-	Christopher Creek Area Freight Improvements	260-277	$7.2	6.4	1.48	1.15	**11**	0%	0%	7%	11%	2%
CS260.13	260-11	-	Mogollon Rim Area Freight Improvements	277-282	$9.5	7.1	1.40	1.20	**12**	0%	0%	10%	18%	3%
CS260.14	260-11	-	Mogollon Rim Area Climbing Lane	277-280	$16.8	0.5	1.36	1.20	**1**	0%	0%	4%	0%	1%
CS260.15	260-12	-	Forest Lakes Area Safety and Freight Improvements	282-304	$56.5	52.1	1.54	1.62	**130**	0%	0%	51%	84%	43%
CS77.16	77-16	A	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	386-389	$92.1	21.6	1.48	2.10	**67**	76%	96%	47%	10%	95%
		B	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	386-389	$75.8	14.9	1.47	2.10	**46**	73%	96%	59%	10%	95%
		C	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)	386-389	$43.8	38.4	1.69	2.10	**136**	100%	100%	47%	99%	95%

* '-': indicates only one solution is being proposed and no options are being considered

6.0 SUMMARY OF CORRIDOR RECOMMENDATIONS

6.1 Prioritized Candidate Solution Recommendations

Table 24 and **Figure 27** show the prioritized candidate solutions recommended for the SR 87/SR 260/SR 377 corridor in ranked order of priority. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Implementation of these solutions is anticipated to improve performance of the SR 87/SR 260/SR 377 corridor. The following observations were noted about the prioritized solutions:

- Most of the anticipated improvements in performance are in the Mobility, Safety, and Freight performance areas
- The highest-ranking solutions tend to have overlapping benefits in the Mobility, Safety, and Freight performance areas
- The highest priority solutions address needs in the Rye area (SR 87 MP 235-241), Salt River area (SR 87 MP 177-182), and near the Payson area (SR 87 MP 246-251)

6.2 Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor recommendations can also be identified. These recommendations could include modifications to the existing Statewide Construction Program, areas for further study, or other corridor-specific recommendations that are not related to construction or policy. The list below identifies other corridor recommendations for the SR 87/SR 260/SR 377 corridor:

- Implement a driving impaired and speeding safety education campaign along the corridor
- Coordinate with AGFD to conduct a study on vehicle/wildlife conflicts on SR 87 between MP 233 and MP 241
- Conduct an access management study on SR 87 and SR 260 through the Town of Payson

6.3 Policy and Initiative Recommendations

In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through this process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on SR 87/SR 260/SR 377, but across the entire state highway system where the conditions are applicable. The following list, which is in no particular order of priority, was derived from the Round 1, Round 2, and Round 3 CPS:

- Install Intelligent Transportation System (ITS) conduit with all new infrastructure projects
- Prepare strategic plans for Closed Circuit Television (CCTV) camera and Road Weather Information System (RWIS) locations statewide
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic message signs (DMS), and call box locations to expand ITS applications across the state
- Consider solar power for lighting and ITS where applicable
- Investigate ice formation prediction technology where applicable
- Conduct highway safety manual evaluation for all future programmed projects
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects
- Develop standardized bridge maintenance procedures so districts can do routine maintenance work
- Review historical ratings and level of previous investment during scoping of pavement and bridge projects; in pavement locations that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project
- Expand programmed and future pavement projects as necessary to include shoulders
- Expand median cable barrier guidelines to account for safety performance
- Install CCTV cameras with all DMS
- In locations with limited communications, use CCTV cameras to provide still images rather than streaming video
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16.25 feet where feasible
- All new or reconstructed roadway/shoulder edges adjacent to an unpaved surface should be constructed with a Safety Edge
- Collision data on tribal lands may be incomplete or inconsistent; additional coordination for data on tribal lands is recommended to ensure adequate reflection of safety issues
- Expand data collection devices statewide to measure freight delay
- Evaluate and accommodate potential changes in freight and goods movement trends that may result from improvements and expansions to the state roadway network

Table 24: Prioritized Recommended Solutions

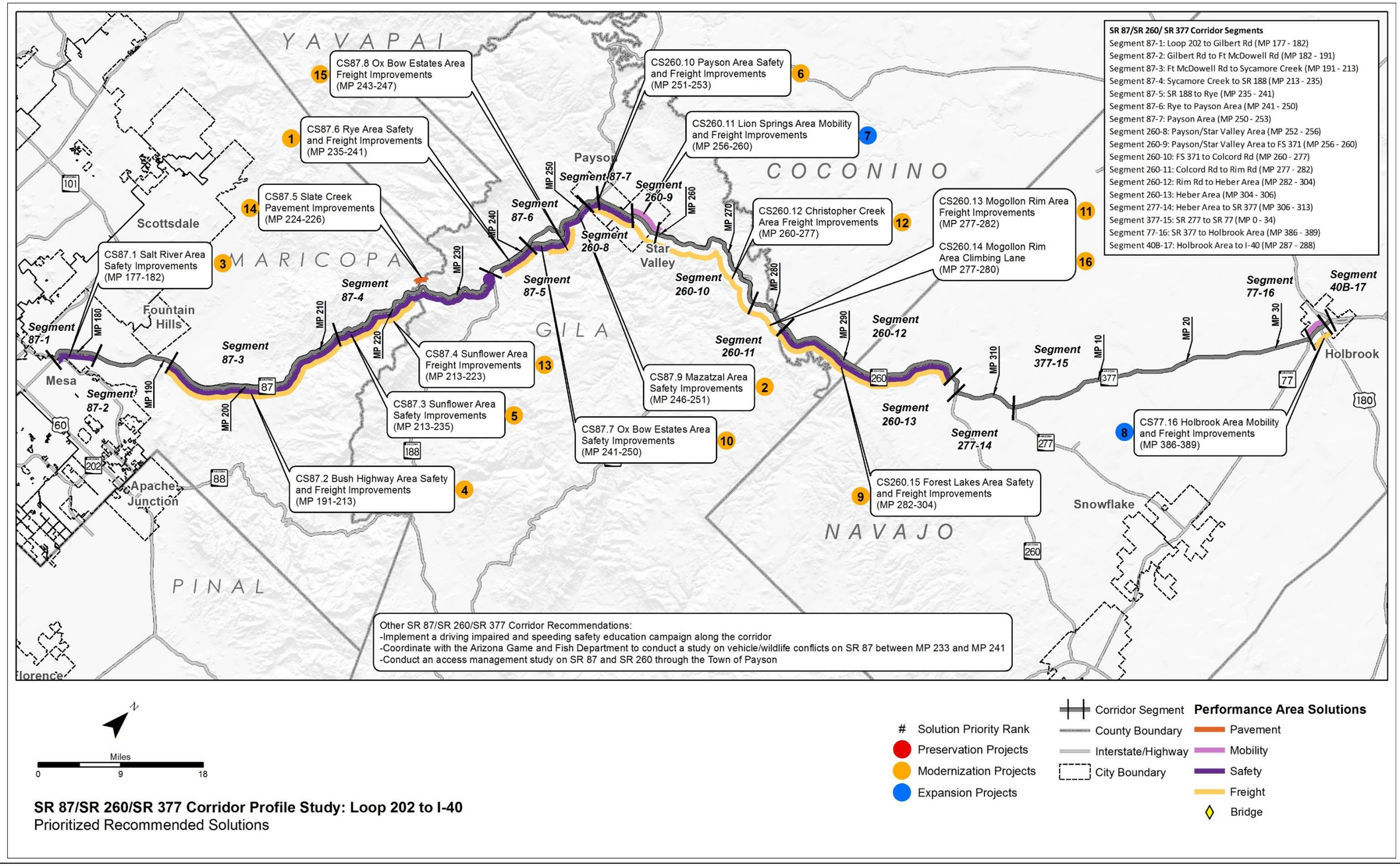
Rank	Candidate Solution #	Option*	Solution Name and Location	Description / Scope	Estimated Cost (in millions)	Investment Category (Preservation [P], Modernization [M], Expansion [E])	Prioritization Score
1	CS87.6	-	Rye Area Safety and Freight Improvements (SR 87 MP 235-241)	-Install advisory sign about approaching area with intersections (Deer Creek Drive [MP 237.6], Gisela Road [MP 239.5], two intersections in Rye [MP 240.5 and MP 240.9]) -Install reduced speed advisory sign on SR 87 (NB MP 240, SB MP 241) -Install speed feedback signs (NB MP 240, SB MP 241) -On SR 188 approaching SR 87 add flashing beacons to WB stop sign	$0.2	M	261
2	CS87.9	-	Mazatzal Area Safety Improvements (SR 87 MP 246-251)	-Widen shoulders SB MP 246.2-250.9	$2.3	M	216
3	CS87.1	-	Salt River Area Safety Improvements (SR 87 MP 177-182)	-Install warning signs and chevrons on curved Salt River bridge approaches -Install raised pavement markers along the outside edge line -Install lighting at Oak St (MP 178.0), Center St (MP 179.1), Mesa Dr (MP 179.7), and Camelback Rd (MP 181.1) -Install raised concrete barrier in median on Salt River bridge and approaches (MP 177-177.5)	$4.7	M	212
4	CS87.2	-	Bush Highway Area Safety and Freight Improvements (SR 87 MP 191-213)	-Rehabilitate shoulders (NB/SB MP 194-205) -Install speed feedback signs (NB MP 206.5 and 207.7, NB/SB before curves and intersection with FR 68 [MP 209.6]) -Widen inside shoulders (SB MP 211-209)	$6.8	M	210
5	CS87.3	-	Sunflower Area Safety Improvements (SR 87 MP 213-235)	-Install speed feedback signs and speed advisory warning signs with flashing beacons at curves (NB MP 213.2, 214.0, 217.8, 220.5, 224.5, 232.5; SB MP 231.0, 229.3, 221.0, 219.6, 216.0, 214.3) -Rehabilitate shoulders -Widen inside shoulders (SB MP 228.5-226.0) -Install rock-fall mitigation (NB MP 214.2-214.6; SB MP 228.9-228.7, 228.5-228.0, 217.6-218.0)	$18.3	M	189
6	CS260.10	-	Payson Area Safety and Freight Improvements (SR 87 MP 251-SR 260 MP 253)	-Implement signal coordination/adaptive control for six signals in Payson urban area (SR 87/SR 260 intersection, SR 260/Payson Village Center, SR 260/Manzanita Dr, SR 87/Main St, SR 87/Bonita St, and SR 87/Green Valley Parkway [BIA101]) -Implement protected/permitted left-turn phasing at SR 87/Manzanita Dr intersection (NB and SB approaches) and provide advance signal advisory sign with flashing beacons WB on SR 260	$0.4	M	171
7	CS260.11	-	Lion Springs Area Mobility and Freight Improvements (SR 260 MP 256-260)	-Reconstruct to 4-lane divided highway (using the existing 2-lane road for one direction) [Design already programmed for FY 2021 in ADOT 5-year program]	$50.0	E	160
8	CS77.16	C	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77) (SR 77 MP 386-389)	-Construct new roadway connection between SR 377/SR 77 and I-40/40B West TI (Exit 285) west of Holbrook; includes new bridge over the Little Colorado River and overpass at railroad crossing	$43.8	E	136
		A	*Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)* (SR 77 MP 386-389)	*-Construct new roadway connection between US 180/SR 77 and I-40/40B West TI (Exit 285) west of Holbrook; includes new bridge over the Little Colorado River and overpass at railroad crossing*	*$92.1*	*E*	*67*
		B	*Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)* (SR 77 MP 386-389)	*-Construct overpass at at-grade railroad crossing and new bridge over the Little Colorado River adjacent to existing SR 77 alignment* *-Remove existing Little Colorado River Bridge*	*$75.8*	*E*	*46*
9	CS260.15	-	Forest Lakes Area Safety and Freight Improvements (SR 260 MP 282-304)	-Widen shoulders -Construct alternating passing lanes (varying locations for 11 miles of the segment)	$56.5	M	130
10	CS87.7	-	Ox Bow Estates Area Safety Improvements (SR 87 MP 241-250)	-Install speed feedback signs and speed advisory warning signs with flashing beacons at curves (SB MP 247, MP 245) -Implement variable speed limits MP 241-246 with new DMS and CCTV SB at MP 247 and new DMS and CCTV NB at MP 240 -Install RWIS at MP 245 with dynamic weather warning beacons	$4.1	M	123
11	CS260.13	-	Mogollon Rim Area Freight Improvements (SR 260 MP 277-282)	-Install centerline rumble strips -Install rock-fall mitigation (WB MP 278.4-278.6, 279.8-280.9, 281.4-282.0) -Install RWIS at MP 282 with dynamic weather warning beacons -Implement variable speed limits at MP 277-282 and new DMS and CCTV at MP 282 WB	$9.5	M	12

Table 24: Prioritized Recommended Solutions (continued)

Rank	Candidate Solution #	Option*	Solution Name and Location	Description / Scope	Estimated Cost (in millions)	Investment Category (Preservation [P], Modernization [M], Expansion [E])	Prioritization Score
12	CS260.12	-	Christopher Creek Area Freight Improvements (SR 260 MP 260-277)	-Install rock-fall mitigation (WB MP 262.2-262.6, 261.6-261.9, 269.0-269.1, 269.7-269.8, 271.3-271.5; EB MP 269.8-269.9, 272.6-272.7) -Implement variable speed limits at MP 272-277 and new DMS and CCTV at MP 272 EB	$7.2	M	11
13	CS87.4	-	Sunflower Area Freight Improvements (SR 87 MP 213-223)	-Construct NB climbing lane, MP 213-215 and MP 219-223 -Widen Whiskey Springs Bridge, #2515 MP 220.32 -Widen Upper Kitty Joe Bridge, #2497 MP 221.39	$43.4	M	10
14	CS87.5	-	Slate Creek Pavement Improvements (SR 87 MP 224-226)	-Replace Pavement	$7.2	M	9
15	CS87.8	-	Ox Bow Estates Area Freight Improvements (SR 87 MP 243-247)	-Construct NB climbing lane	$22.4	M	2
16	CS260.14	-	Mogollon Rim Area Climbing Lane (SR 260 MP 277-280)	-Construct EB climbing lane	$16.8	M	1

* '-': indicates only one solution is being proposed and no options are being considered

Figure 27: Prioritized Recommended Solutions



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Prioritized Recommended Solutions

6.4 Next Steps

The candidate solutions recommended in this study are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT's traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the SR 87/SR 260/SR 377 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related to the ultimate vision for the corridor that may have been defined in the context of prior planning studies and/or design concept reports. Recommendations from such studies are still relevant to addressing the ultimate corridor objectives.

Upon completion of all three CPS rounds, the results will be incorporated into a summary document comparing all corridors that is expected to provide a performance-based review of statewide needs and candidate solutions.